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BUTTERFLIES AND MOTHS

IN ROMANCE AND REALITY

BY

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WITH NUMEROUS COLOURED PLATES AND OTHER ILLUSTRATIONS

December Moth (*Pœcilocampa populi*).

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INTRODUCTION

WHAT ARE BUTTERFLIES AND MOTHS?

Butterflies and Moths have no framework of bones inside their bodies, but they are composed of a number of joints, or divisions, called segments, and are covered by a tough skin, which protects them from injury, and to which the muscles are attached. We therefore know them to belong to the immense series of animals known as the Sub-kingdom *Annulosa* or *Articulata*; and when we examine them further, we find that their bodies are divided into three principal parts; the Head, which contains most of the sense-organs; the Thorax, to which the legs and wings are attached; and the Abdomen. In the perfect state, they have two long jointed organs, called Antennæ, and only six legs. The characters mentioned are sufficient to separate them from Spiders, Crabs, Centipedes, etc., and to show us that Butterflies and Moths belong to the important class of Insects.

We have now to consider how butterflies and moths differ from other insects.

Insects are divided into seven great Divisions, or Orders, which fall under two well-marked Sections, the first called *Mandibulata*, possessing mandibles in the perfect state; and the second *Haustellata*, in which the mandibles are often slightly developed in the perfect state, and the insect imbibes its food through a proboscis. A tongue or proboscis, varying in form, exists, however, in the *Mandibulata* also.

The seven principal Orders of Insects are: *Coleoptera*, or Beetles; *Orthoptera*, including Earwigs, Cockroaches, Crickets, Grasshoppers and Locusts; *Neuroptera*, including Dragonflies, Mayflies, Caddis-flies, Lacewinged-flies, etc., and some aberrant groups frequently regarded as forming small separate Orders; and *Hymenoptera*, including Sawflies, Ichneumons, Bees, Wasps, and Ants, etc.: these are the Mandibulate Orders of Insects.

To the Haustellate Insects belong the *Lepidoptera*, or Butterflies and Moths; the *Hemiptera*, or Bugs, Froghoppers and Plant-lice; and the *Diptera*, or Two-winged Flies and Fleas. A fuller account of insects in general will be found in my "Elementary

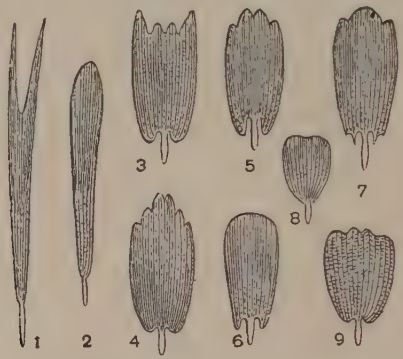

Fig. i.—Various forms of the Scales of Butterflies.

(1) and (5) *Euchloë cardamines*; (2) and (3) *Pamphila sylvanus*; (4) and (8) *Argynnis adippe*; (6) and (7) *Polyommatus icarus*; (9) *Argynnis aglaia*.

Textbook of Entomology," and in numerous other general works on the subject.

If we grasp a butterfly or moth roughly, the delicate wings will be crushed and broken, and some fine dust will be rubbed

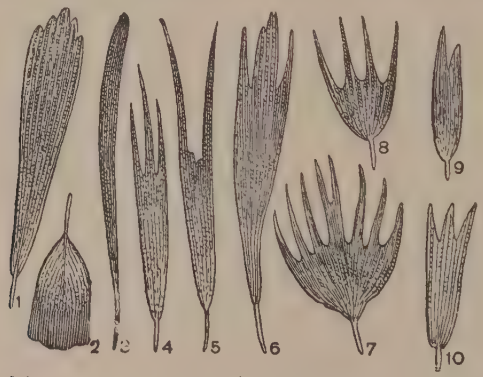

Fig. ii.—Various forms of the Scales of Moths.

(1) and (2) *Trypanus cossus*; (3) *Sphinx ligustri*; (4) to (8) *Dendrolimus pini*; (9) and (10) *Hypercompa villica*.

off on our fingers; and if we examine this under a microscope, we shall find that it consists of beautifully-formed scales (Figs. i. and ii.), varying in shape, which lie closely together on the wing, like tiles on the roof of a house (Fig. iii.). When these are rubbed

off, a colourless membrane is left, intersected by stiff air-tubes called nervures or veins, which form the framework of the wing. The beautiful colours of butterflies and moths are wholly due to the scales, not only directly, but in many cases, by the

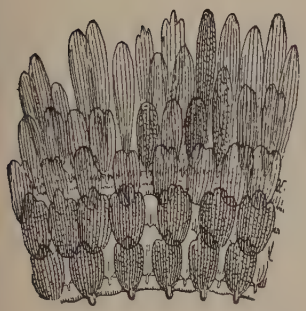

Fig. iii.—Arrangement of the Scales on the Wing of *Pieris brassicæ*.

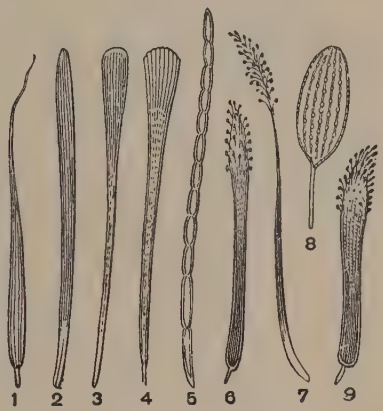

Fig. iv.—Hairs of Butterflies.

(1) *Hesperia malvæ*; (2) and (8) *Polyommatus icarus*; (3) and (4) *Pamphila sylvanus*; (5) *Pamphila comma*; (6) and (9) *Argynnis aglaia*; (7) *Argynnis adippe*.

prismatic reflection from their surfaces, which in some cases is of extraordinary brilliancy, exceeding that of the most beautiful tropical birds. In addition to the scales, the bodies and often parts of the wings of butterflies and moths are more or less thickly clothed with hair and down (Fig. iv.); but it is the scales of the wings which form the most distinctive character of these insects, as distinguished from others, and they are therefore known as *Lepidoptera* or Scale-winged Insects, a designation based on two Greek words, λεπίς, a scale, and πτέρον, a wing. Besides the characters to which we have called special attention, *Lepidoptera* are generally provided with one or two pairs of jointed organs called palpi (Fig. v.) (*c*), in addition to the antennæ (*a*), and often with two simple eyes, or *ocelli*, in addition to the large facetted compound eyes (*b*), which latter, when magnified, present something of the appearance of a

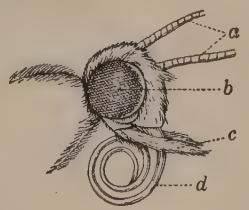

Fig. v.—Head of a Butterfly, showing (*a*) Antennæ, (*b*) Facetted Eye, (*c*) Palpi, (*d*) Trunk or Proboscis.

multiplying glass. The number of facets differs in different insects from a few score to some thousands.

THE DEVELOPMENT OF BUTTERFLIES AND MOTHS

Butterflies and Moths pass through what is called a perfect metamorphosis. Insects with imperfect metamorphoses, such as the bulk of the *Orthoptera* and *Neuroptera*, leave the egg nearly in their perfect form, but without wings, and develop by a series of moults ; but those with a perfect metamorphosis

Fig. vi.—Ova or Eggs of the Buff Tip (*Phalera bucephala*), from a photograph, magnified about twelve diameters.

pass through a series of four very dissimilar conditions, known in the case of *Lepidoptera* as ovum, or egg ; larva or caterpillar, pupa or chrysalis ; and imago, or perfect insect.

The eggs of *Lepidoptera* (Fig. vi.) are small and variously shaped, being egg-shaped, globular, flask-shaped, barrel-shaped, etc., and sometimes hollow or with a depression. They may be smooth, ribbed, reticulated, or covered with small raised lumps or tiny depressions. In colour they are most commonly pale green or yellow, but some are brown, blue, or red, and some eggs are spotted. The eggs are laid by the female insect, either singly or in masses, attached by an adhesive substance, on the leaves or stems of the food-plant, and usually take

from one to two weeks to develop, though some eggs laid in the autumn are not hatched until the following spring, when the young caterpillars emerge.

With very few exceptions, the larvæ of butterflies and moths are exclusively vegetable feeders. A caterpillar moults several times, and finally throws off its last skin, and appears as an almost motionless chrysalis, which may be suspended by threads, or enclosed in a silken covering called a cocoon, or else hidden among leaves, in chinks of bark, or buried in the ground. When the butterfly or moth is ready to emerge after a longer or shorter time, the chrysalis bursts, and the insect creeps out, provided with six legs, and four wings (Fig. vii.). The body is soft and bloated, and the wings are mere short flabby rudiments; but fluid is pumped into the nervures of the wings, which gradually expand to their full size, and dry in the air. The insect has now arrived at its last and final stage, and is ready to fly away, and reproduce its kind.

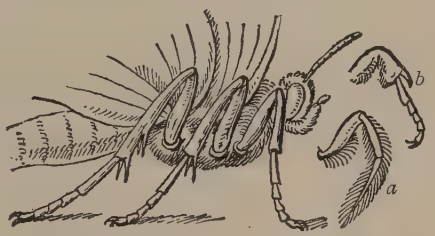

Fig. vii.—Side view of body of Butterfly, showing the Legs; (*a*) rudimentary leg with hairs; (*b*) leg showing spine at end of tibia, and claws at end of the jointed tarsus.

NUMBERS, DESTRUCTIVENESS, AND ENEMIES OF BUTTERFLIES AND MOTHS

There is an enormous number of different kinds of insects in the world; and perhaps about half a million have already been described from all parts of the globe; the actual number in existence is variously guessed at as from two to ten millions; and I must say that the smaller estimate appears to me to be absurdly low. In the British Islands we have probably somewhere between 16,000 and 20,000 different kinds of insects; and of these, rather more than 2000 are butterflies and moths, the butterflies numbering only about 70 species of this total.

By some accident, a short notice of one of my earliest entomological publications ("A Manual of European Butterflies"), 1862, found its way into the "Court Journal" of that year, and included the following amusing passage: "Think of 320 species of butterflies! But there are doubtless twice as

many, for these 320 species are found on the Continent of Europe alone."

This is not the only amusing *contretemps* connected with this book. I read, in a bibliographical work, including a list of my publications, "A Manual of European Butterflies (1862), ed. Dimiryaht, an Oriental Romance, and other Poems" (1867); thus representing that the former book was edited for me by one of King Solomon's Viziers.

As insects lay a large number of eggs, those which feed on useful plants are often very destructive. We have already said that caterpillars are almost exclusively vegetable feeders; and while some will feed on almost any kind of plant, others confine themselves absolutely to a single plant, or perhaps two or three allied species, and will die if they cannot obtain their appropriate food. But they cannot multiply unchecked, for *Lepidoptera* in their various stages, and more especially as caterpillars, are exposed to the attacks of a great number of enemies, which help to keep down their numbers within reasonable bounds. Birds destroy enormous numbers of caterpillars, and it is probably owing to the protection granted to birds in Britain, especially of late years, as well as to the circumstance that our changeable climate is not favourable to insect life, that our crops usually suffer much less from insect attacks than those of the Continents of Europe and North America. Caterpillars have still more formidable enemies among insects themselves. Some of the Sand Wasps store up paralysed caterpillars as food for their own grubs; and worse still, the great hosts of four-winged parasitic insects known as Ichneumon flies, lay their eggs in or on the bodies of caterpillars, and when these are hatched, the grubs devour the interior of the unfortunate caterpillar till it is full grown, and then leave it as an empty carcass about the time that it ought to become a chrysalis. Sometimes the caterpillar succeeds in becoming a chrysalis, from which the flies afterwards emerge, instead of a butterfly or moth. There is also a family of parasitic two-winged flies, belonging to the Order *Diptera*, resembling bristly house flies, which have similar habits.

The smallest insects known belong to a family of *Hymenoptera* called *Mymaridæ*, or Fairy Flies. They are parasitic in the eggs of butterflies and other insects.

A practised eye can just observe them on a lighted window-pane; but of late years special attention has been called to them, and a considerable number of species have now been

discovered. Under the microscope they are seen to possess beautiful oval or battle-dore shaped wings with long hairs radiating round the edges.

In the perfect state butterflies and moths feed entirely on liquid food; the nectar of flowers, the exuding sap of trees, or the juice of over-ripe or decaying fruit; and they may often be seen, sometimes in considerable numbers of the same or different species, imbibing the moisture from damp ground or puddles, or (especially in the tropics) even from dung or carrion.

But by far the larger number derive their nourishment from flowers. Even some of the species, with such a rudimentary proboscis that they can hardly imbibe food, occasionally visit flowers or sugared trees, probably like Peris, for the sake of the odour.

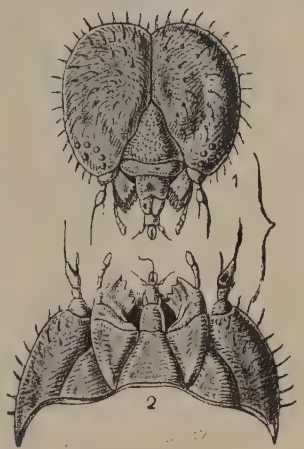

Fig. viii.—Head of a Caterpillar, showing the Jaws (1) from above, (2) from below.

Caterpillars differ from butterflies and moths in possessing strong jaws (Fig. viii.), and more than six legs. They have six legs in the front of the body, corresponding to the legs of the perfect insect (Fig. ix. [1]), and in addition, four pairs of fleshy legs, called prolegs (Fig. ix. [2–4]), in the hind part of the body, and two additional ones, called claspers, at the extremity, thus making sixteen legs in all.

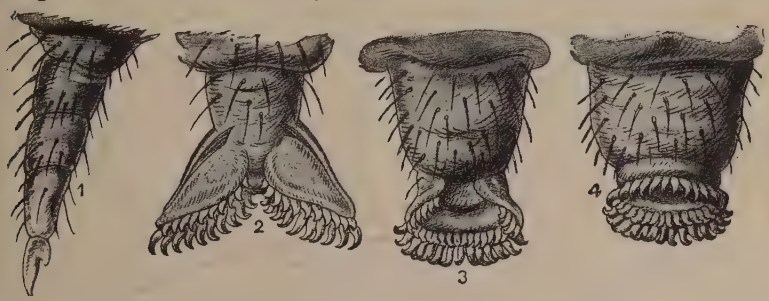

Fig. ix.—Legs of Caterpillars.

(1) True leg; (2)—(4) Prolegs; (2) with laterally movable pads; (3) with incomplete circle of hooks; (4) with complete circle of hooks.

In many caterpillars, especially those of the moths known as *Geometræ*, or Loopers, one, two or three pairs of prolegs

are more or less obsolete; and these caterpillars exhibit a very peculiar gait. They fix themselves by their claspers and the hind pair of prolegs, stretch out their bodies to the full length, secure themselves by their true legs, and bring up the hind part of the body by arching the back into a loop, when they fix themselves again, and repeat the manœuvre. Many of these caterpillars creep in this odd manner much faster than one would imagine them capable of; but they are usually sluggish in their habits, and will often fix themselves to a branch, and stretch out their bodies stiffly, and remain motionless in this position for a long time, looking for all the world like bits of stick, a resemblance which is often much increased by the humps and protuberances on their bodies. The grubs of various Sawflies resemble caterpillars, in some cases very closely, and they have sometimes been called "false caterpillars"; but they can always be distinguished at a glance from true caterpillars (*i.e.* those of butterflies and moths) by possessing more than sixteen legs, which is the normal number in the latter.

In England we speak of butterflies and moths, but on the Continent they make no such distinction, but call them by names equivalent to Day-butterflies and Night-butterflies.

Having got so far, let us inquire into the difference between a butterfly and a moth. And here we may say that although there are no very deeply-rooted scientific distinctions of the

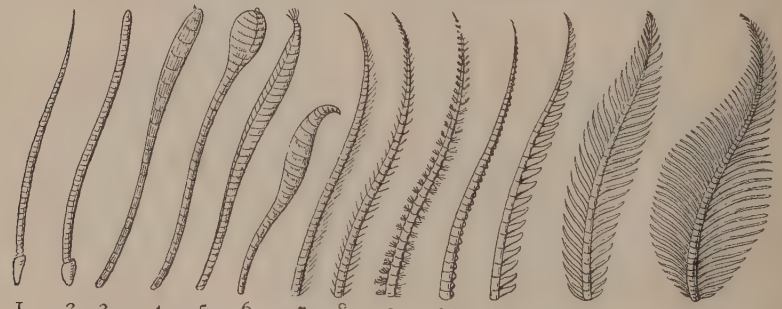

Fig. x.—Various forms of the Antennæ in Butterflies and Moths.

(1) Setiform; (2) Filiform; (3) Clavate; (4) Capitate; (5) Fusiform; (6) Hook-shaped; (7) Ciliated; (8) Setose; (9) Fasciculated, or Tufted; (10) Dentated; (11) Serrated; (12) Pectinated; (13) Plumose.

first importance, yet the five families of *Lepidoptera* called butterflies are exceedingly well-defined and recognisable, and there are very few species which can be regarded as in any way intermediate between the families called butterflies and any

of those known as moths. The most salient character by which butterflies may be distinguished apart from the characters of their families, is the structure of the antennæ (Fig. x.). In butterflies these organs are always knobbed or thickened at the extremity, which is not the case in any British moth and in very few foreign ones; and though the antennæ of the Burnet moths are much thickened, they are generally pointed at the extreme tip, and are totally unlike those of any true butterfly. On the other hand the antennæ of moths are of very various shapes, and are often hairy or feathered. The Ant-lion flies, and one or two other non-British insects allied to the Dragonflies, have clubbed antennæ resembling those of a butterfly; and among British insects several *Hymenoptera* and *Coleoptera* have similar antennæ; but these have transparent, or at least scaleless wings, or else have horny tegmina or fore wings. It is, however, curious that some Sawflies which exhibit this structure of the antennæ, have plant-feeding grubs which, as we have already mentioned, closely resemble caterpillars, except in the number of legs.

CLASSES OF BUTTERFLIES AND MOTHS

The first five families of *Lepidoptera*, including butterflies, are often called *Rhopalocera*, from the Greek words ῥόπαλον, a club, and κέρας, a horn, on account of their club-shaped antennæ; and moths are called *Heterocera*, from the word ἕτέρος, different, and κέρας, a horn, because their antennæ are differently shaped from those of butterflies. The butterflies and several groups of the larger moths are also frequently called *Macro-Lepidoptera*, which includes roughly about half the species; the remaining groups of moths, mostly including species of small size, being called *Micro-Lepidoptera*. But it is hardly necessary to point out that this distinction is not absolute (for many species classed as *Macro-Lepidoptera* are smaller than some of those included among the *Micro-Lepidoptera*), and it is in no sense scientific.

In order to distinguish between insects of different kinds, it is necessary to classify them into larger and smaller sections, which are called Families, Sub-families, and Genera, while the different kinds are known as Species. Species consist of a number of individuals which are perfectly fertile among themselves, and which always breed true within certain limits. Frequently the male and female of a species resemble each other

very closely, but sometimes they differ so much that no one could imagine them to belong to the same species, unless the connection had been absolutely proved. The female, as the most important sex, in insects at least, requires most protection, and we therefore usually find the female of less conspicuous colours than the male; or in extreme cases of what is called sexual dimorphism, the female may even assume the perfect colouring of a butterfly of a different family, which has some special protection against its enemies, and thus shares in its advantages.

This phenomenon is frequently called " mimicry " ; but, of course, the term is only used in a metaphorical sense. The most extreme form of sexual dimorphism is found in some of the *Psychidæ*, or Case-moths, in which the males are active insects, with well-formed wings and antennæ, while the females are sometimes quite destitute of these organs, and are reduced to mere helpless egg-bags.

Another frequent and regular form of variation within the same species is called seasonal dimorphism. This happens when a species has two or more broods in the year, and the individuals belonging to one brood, though proceeding from eggs laid by those of another, differ so much that they might easily be regarded as distinct species. This is very noticeable in the broods of some British moths belonging to a family of *Geometræ* called *Ennomidæ* or Thorns, but it is still more noticeable in the Map butterfly, a European species not found in England, which is about the size of a small Fritillary, but is allied to the Angle-winged butterflies. The spring brood, *Araschnia levana*, is like a very small Painted Lady, but the summer brood (known as *Araschnia prorsa*) is black, with white spots and narrow white bands, like a very small White Admiral.

In India, many butterflies exhibit similar remarkable differences, which are known as wet-season and dry-season forms. Of less importance than these forms are those known as varieties, for no two individuals are exactly alike in all particulars, and we may find differences in colour or size, or in the markings, some of which may be absent or run together. Occasionally, too, we may meet with specimens which are apparently hermaphrodite, having the colour or structure of the male on one side of the body, and that of the female on the other. Of course this is only likely to attract attention in species in which the colour of the wings or the

structure of the antennæ is conspicuously different in the two sexes.

BUTTERFLIES IN POETRY, ETC.

There are many references to butterflies in the English Poets, some of which we shall refer to under special headings. One of the earliest and most interesting is Spenser's "Muiopotmos, or the Fate of the Butterfly." It is too long to print here in its entirety, but we may quote one stanza, describing the creation of the butterfly by Minerva.

> "Emongst these leaves she made a Butterflie,
> With excellent device and wondrous slight,
> Fluttring among the Olives wantonly,
> That seem'd to live, so like it was in sight:
> The velvet nap which in his wings doth lie,
> The silken downe with which his backe is dight,
> His broad outstretched hornes, his hayrie thies,
> His glorious colours, and his glistering eies."

There is a pretty song (by T. H. Bayly) called "I'd be a Butterfly," which was once very popular, whilst "The Butterfly's Ball and the Grasshopper's Feast" and "The Butterfly's Birthday," by W. Roscoe, are well known in nursery books for children.

Several writers of juvenile books have dealt with the confusion caused in school by the sudden appearance of a butterfly. Thus, in one of Anne and Jane Taylor's poems, "The Morning Task," we read of a father who promised to take his children for a pleasant walk when they had finished their lessons. But one boy was not inclined to work, and when "a lovely painted butterfly" (probably a *Vanessa*) came in at the window, he ran away after it, and pursued it till it disappeared; and on going home, found that the others had all gone out without him. Similarly, in America, Jacob Abbott, in "Rollo at School," tells a story of a girl who brought a big butterfly with her to school, and, being conscience-stricken, threw it out of the window, but a breeze blew it back into the room, and of course it interrupted the work of the scholars. The large black-and-tawny butterfly called the Monarch, in America (*Danaus plexippus*), is probably intended.

Butterfly collectors sometimes figure in comic literature. In a farce called "Milky White," we meet with a tipsy Entomologist who was a member of the Entomological Society of Truro; and there is an oblong volume illustrated by Cruikshank, setting forth the wonderful adventures of Mr. Bachelor

Butterfly, who, " when he has caught a butterfly, pins it to his hat." He goes abroad, where he is made a slave of by the Moors ; gets swallowed by a whale, where he meets a large assembly in a similar predicament ; is cast up on shore, and ultimately, like Mr. Verdant Green, is " married and done for."

Among American writers, Robert W. Chambers frequently alludes to butterflies in a way which shows him to possess a practical knowledge of the subject. English novelists, however, if they allude to Natural History matters at all, often make the most astounding blunders, such as writing of rattlesnakes in India, cobras in California, or white bears at the South Pole. As regards dictionaries, I have seldom seen one in any language in which the commonest names of animals (including insects) and flowers were not egregiously mistranslated. It is only fair, however, to make an exception in the case of Finnish dictionaries, in which the scientific name is usually added, identifying the species without the possibility of doubt.

SIR JOSEPH BANKS AND THE EMPEROR OF MOROCCO

Although Sir Joseph Banks was perhaps primarily a botanist, yet he was an all-round man who paid much attention to Entomology among other subjects, and his collection of insects was one of the most important of his time, and it still remains in fairly good preservation in the Natural History Museum, South Kensington. It was one of the principal sources on which J. C. Fabricius founded the works which laid the foundation, after Linnæus, of the modern science of Entomology. Fabricius himself was one of the favourite pupils of Linnæus, who recognized him as his superior in Entomology.

Sir Joseph was much ridiculed for his love for Entomology and for butterfly collecting, by the wits of the period. In Edward Smith's recently-published " Life of Sir Joseph Banks," we read (p. 178)—

" Generally we learn that Banks made of the Royal Society a Fly Club, and tried to amuse them with frogs, and flies, and grasshoppers, and weed- and- birds'-nest- hunting. Opposite is a picture of ' A Feast at the Fly Club,' representing Sir Joseph Banks and his associates feasting on antelope's skull, crocodiles, etc."

Further on, in Smith's work (pp. 180, 181), we read—

" A few years later, James Gillray essayed a sportive picture of Banks. It is reproduced on the adjoining page. It will be

noticed that there is some grace about it all. The idea that this particular butterfly was specially attracted by the Crown is absurd enough; but there were many ill-natured people of the time who regarded Banks as something of a toady. The legend runs thus:

"'The Great Sea Caterpillar, transformed into a Bath Butterfly.

"'Description of the new Bath Butterfly, taken from the Philosophical Transactions for 1795. This Insect first crawled into notice from among the weeds and mud of the South Sea; and, being afterwards placed in a warm situation by the Royal Society, was changed by the heat of the sun into its present form. It is notic'd and valued solely on account of the beautiful Red which encircles its body, and the shining spot on its breast; a distinction which never fails to render caterpillars valuable." Banks had just been made a K.B.

The picture represents a mudflat on which caterpillars are crawling, from which emerges an object shaped something like a sea-cucumber, adorned with leafy sprays, and bearing the head of Banks, with a decoration on the breast, and with four large wings, adorned with representations of a star-fish, lobster, spider, etc.

It is hardly necessary to note that there is an insect known as the Bath White butterfly, which is very rare in England, though common on the Continent.

One of the principal satirical writers of the period was Dr. John Wolcot, who wrote under the pseudonym of "Peter Pindar," and was never tired of poking fun at Sir Joseph in his rather scurrilous effusions.

The story begins with a satirical account of Sir Joseph's exploits as a naturalist and Fellow of the Royal Society. The following passage evidently refers to the caricature we have already mentioned:—

> "I can't say that Sir Joseph lions kills,
> Hugs giants, or the blood of hydras spills,
> But then most manfully he eats a bat,
> Eats toads, or tough or tender, old or young,
> As in the sweetest strains the Muse hath sung,
> Fit with the hugest Hottentot to cope,
> Who dines on raw flesh at the Cape of Hope."

Peter then relates how Sir Joseph set forth one day on a butterfly-hunting expedition, and first offered up a prayer

that the Plague of Flies might be repeated for him to pick and choose.

"Pharaoh had not one grain of taste,
The flies on him were thrown to waste,
Nay, met with strong objection;
But had Thy servant, Lord, been there,
I should have made, or much I err,
A wonderful collection."

Then Sir Joseph began to trot round the fields—

"When from a dab of dung, or some such thing,
An Emperor of Morocco rear'd his wing!"

The Purple Emperor Butterfly, which often perches on carrion, etc., is no doubt intended, though Bulwer Lytton, the only other writer, so far as I know, who mentions a butterfly under the name of the Emperor of Morocco, misapplies the name to the Swallow-tail Butterfly. I may note that the genus *Apatura*, to which the Purple Emperor belongs, is not found in Morocco or North Africa at all.

Shouting with excitement, Sir Joseph chased the butterfly.

"Lightly with winnowing wing amid the land,
His Moorish Majesty in circles flew!
With sturdy striding legs and outstretched hand
The Virtuoso did his game pursue.
He strikes—he misses—strikes again—he grins,
And sees in thought the monarch fixed with pins;
Sees him on paper giving up the ghost,
Nail'd like a hawk or martyr to a post."

Sir Joseph fell several times in the course of his pursuit, to the amazement of a countryman standing near a hedge.

"Now through the hedge, exactly like a horse,
Wild plunged the President with all his force,
His brow in sweat, his soul in perturbation,
Mindless of trees and bushes and the brambles,
Head over heels into the lane he scrambles,
Where Hob stood lost in wide-mouth'd speculation.

"'Speak,' roared the President, 'this instant say
Hast seen, hast seen, my lad, this way,
The Emp'ror of Morocco pass?'
Hob to the insect-hunter naught reply'd,
But shook his head, and sympathising sigh'd, 'Alas,
Poor Gentleman, I'm sorry for ye,
And pity much your *upper story!*'"

Sir Joseph raced down the lane, and presently saw the butterfly fly over a garden wall. He rushed through the door, knocking down the gardener, the bell-glasses and the scarecrow,

and trampling down hyacinths, tulips, anemones and carnations by the score and by the hundred in his mad pursuit. Next he overturned a hive of bees, but in his excitement he was impervious to their attacks, and rushed on in pursuit of the butterfly, pursued in his turn by the furious gardener.

"At length the gard'ner swelled with grief and dolour,
O'ertaking, grasps Sir Joseph by the collar,
And blest with favourite oaths, abundance showers,
'Villain,' he cry'd, 'beyond example!
Just like a cart-horse on my beds to trample!
More than your soul is worth to kill my flowers!
See how your two vile hoofs have made a wreck.
Look, rascal, at each beauty's broken neck!'"

Sir Joseph broke out into lamentations over the loss of the butterfly.

"'Gone is my soul's desire, for ever gone!'
'Who's gone?' the gard'ner strait reply'd.
'The Emperor, Sir,' with tears Sir Joseph cry'd,
'The Emp'ror of Morocco, thought my own!
To unknown fields behold the monarch fly,
Zounds, not to catch him what an ass was I!'
His eyes the Gard'ner full of horror stretch'd,
And then a groan, a monstrous groan he fetch'd,
Contemplating around his ruined wares;
And now he let Sir Joseph's collar go;
And now he bray'd aloud with bitterest woe,
'Mad, madder than the maddest of March hares!'"

BUTTERFLIES AND PSYCHE

When at rest, butterflies generally raise their wings above their bodies, whereas moths less frequently adopt this position, usually opening their wings, and expanding them flat, or folding the hind wings like a fan, with the fore wings overlapping above them.

Butterflies are generally slender-bodied insects, with broad wings of nearly uniform size, texture, and colour; and are white, yellow, blue or brown, or of some shade of tawny or reddish. Green and grey, when they occur, are chiefly found on the underside of the wings. They usually fly only by day, and especially in the sunshine. They do not begin to fly till the dew is dried off the grass, nor do they fly much towards evening, nor in the rain, and even in dull weather in summer you will not see many flying about. Though the larger species are strong on the wing, and some have a very rapid flight, most of them fly near the ground, and settle frequently on flowers, and more rarely on leaves, and are not usually difficult to capture with

a net. Some butterflies will settle on the bare ground, especially where it is damp, like the bottom of a half-dry ditch, or on rocks or walls, or on the bole of a tree ; and in the last case, it is very difficult to capture them. In the evening butterflies, chiefly small ones, may often be found asleep, clinging to the stems of long grass or rushes, or may be beaten, like moths, from bushes or hedges.

The beauty of butterflies early attracted attention and admiration, and when it was discovered that they passed through their earlier stages as an egg, a greedy caterpillar, and a helpless and almost motionless chrysalis, it is not surprising that the butterfly should have been adopted as a symbol of the soul, and the same word, Psyche, applied to both. In Greek and Roman art, Psyche, the wife of Cupid, is usually represented as a girl with butterfly's wings, just as Cupid is represented as a boy with small bird's wings.

We may perhaps digress a little here to give a brief outline of the beautiful classical fairy tale of Cupid and Psyche. Psyche was a princess who was so lovely that she excited the jealousy of Venus, who sent Cupid to punish her for being as beautiful as herself. But Cupid fell in love with her, and carried her away secretly to his palace, where he married her, and used to visit her only at night, forbidding her to seek to discover who he was. But she begged him to allow her sisters to visit her, and when he reluctantly consented, they were so envious of her good fortune that they persuaded her to hide a lamp in the room, and look at him when he was asleep. A drop of hot oil fell on his shoulder and roused him ; and he flew away, declaring that she would never see him again. After this, Psyche fell into the power of Venus, who imposed upon her a series of impossible tasks, which she succeeded in accomplishing with the secret aid of Cupid ; and at length she was finally reconciled to him and his mother.

In modern Entomological nomenclature, the name *Psyche* has inappropriately been used for a genus of small dull-coloured moths with wingless females.

In Gesner's German story of the " Death of Abel " (a book less read now than a few years ago), the first human family are pictured as deriving much consolation from observing the emergence of a butterfly from the chrysalis.

Mrs. Gatty also, in her " Parables from Nature," uses the changes of a White Cabbage butterfly as an illustration of immortality, in a very pleasing manner.

ON THE IMPORTANCE OF THE STUDY OF BUTTERFLIES AND MOTHS

For many years the study of Entomology and the collection of insects was treated with very scant respect in England. In the reign of Charles II. there lived a certain Lady Glanville, whose name has been attached to a well-known butterfly, *Melitæa cinxia* (Plate IV., fig. 2), which she was perhaps the first to call attention to in this country, and which is still known as the Glanville Fritillary. When she died, an attempt was made to set aside her will on the ground of insanity, and the chief evidence brought forward to support the contention was her fancy for collecting butterflies.

As late as 1815, when Kirby and Spence published their "Introduction to Entomology," they considered it necessary to begin by replying to three principal objections: "That Entomology is a trifling pursuit;" "That Entomologists confine themselves chiefly to nomenclature;" and "That it leads to cruelty."

To reply to the second objection first, it is obvious that when you have to deal with hundreds of thousands, if not actually millions, of species, it is necessary to have definite systems of classification and nomenclature by which any given species can be identified; and therefore nomenclature, though of course only a means to an end, is of much real importance. As regards cruelty, of course any study which involves the destruction or interference with animal life, *may* be carried out cruelly and recklessly; but there is no reason why this should always be the case. Insects can be reared from their earlier stages, and many interesting observations may be made without taking life at all; and if insects are killed for the collection, no right-feeling collector will destroy more than he requires. To catch indiscriminately every specimen of a rare species you can see, or, worse still (as has occasionally happened), with the deliberate intention of exterminating it, so that no one after you shall get any more, cannot be too strongly denounced.

Entomology can no longer be deemed a trifling pursuit, as it was by some persons in the days of Kirby and Spence. It is now known that the germs of nearly all the most formidable diseases which afflict humanity are conveyed by flies, fleas, and other insects; and their study is consequently a matter of life and death to thousands of human beings, and largely affects the habitability of vast countries, especially in the

tropics. We cannot actually claim quite the same importance for the study of butterflies and moths, yet it is not a subject which can be looked down upon at the present day, either from a commercial and agricultural point of view, or from that of scientific interest.

We cannot take up any book on the question of evolution or the habits of animals, without seeing frequent reference made to butterflies and moths, especially as regards variation, adaptation to environment, their senses, visits to flowers, metamorphoses, migrations, parasites and enemies, economic importance, as destructive to vegetation, or as silk-producers, or even occasionally as articles of food.

It has sometimes happened, too, that Entomologists in foreign countries have been supposed to collect insects for magical purposes, for which select fragments of all sorts of animals—"eye of newt, and toe of frog," etc.—have been employed in all ages and countries.

Among the insects which destroy our crops, the caterpillars of butterflies and moths sometimes play a very considerable part; and unless we acquaint ourselves with their habits, modes of attack, enemies, etc., we are at a great disadvantage in our efforts to destroy them or to counteract their ravages.

BUTTERFLIES AND MOTHS

THE SWALLOW-TAILED BUTTERFLIES

The word *Papilio* means a butterfly, and it is used as the generic name for a large group of handsome butterflies, which are very numerous in the tropics, but of which only four different kinds are found in Europe. The family *Papilionidæ*, to which they belong, has six legs fitted for walking, in both sexes ; the caterpillars have a retractile fork on the neck, and the chrysalis is fixed by the tail, and has a belt of silk round the body. Many of these butterflies, but not all, are ornamented with a long appendage to the hind wings, which is commonly but incorrectly called a tail.

If we visit the Norfolk Broads in summer, we may happen to see a large yellow and black butterfly flying rather low down over the rank herbage, and occasionally settling on a flower. This is the Swallow-tail butterfly (*Papilio machaon*, Plate I., fig. 2), the only representative in England of the group to which it belongs. Though common throughout Europe and Asia, and once found throughout Southern England as far north as Yorkshire, it is now confined, in Britain, to a few localities in the fenny districts of the south-east of England, though it is generally common on the Continent, especially in meadows and clover fields. The caterpillar is green, with transverse orange-spotted black bands, and on the neck is a forked orange tentacle which is protruded on any alarm, and which emits a strong scent. No doubt this apparatus is useful for driving off some of the insect's enemies. A similar structure is found in all the members of the sub-family *Papilioninæ*. The favourite food of the caterpillar in England is a plant called Milk Parsley (*Peucedanum palustre*), but on the Continent it feeds indiscriminately on a great variety of Umbelliferous plants, and I have found it commonly on carrot leaves in gardens in Germany.

Why so many insects which are common abroad and feed on common plants should be so restricted both in their range and food in the British Islands, is very difficult to explain.

It is apparently this insect to which Bulwer Lytton alludes in "Kenelm Chillingby" (Book V. ch. 5), under the name of the "Emperor of Morocco," though this name properly belongs to the Purple Emperor.

"A few minutes afterwards Kenelm was walking by the side of Lily along the banks of a little stream, tributary to the Thames. . . . Suddenly Lily left his side, allured by a rare butterfly—I think it is called the Emperor of Morocco—that was sunning its yellow wings upon a group of wild reeds. She succeeded in capturing this wanderer in her straw hat, over which she threw her sun-veil. After this notable capture she returned demurely to Kenelm's side.

"'Do you collect insects?' said that philosopher, as much surprised as it was his nature to be at anything.

"'Only butterflies,' answered Lily; 'they are not insects, you know; they are souls.'

"'Emblems of souls, you mean—at least, so the Greeks prettily represented them to be.'

"'No, real souls—the souls of infants that die in their cradles unbaptized; and if they are taken care of, and not eaten by birds, and live a year, then they pass into fairies. . . . I will show you my collection when we get home—they seem so happy. I am sure there are some of them that know me—they will feed from my hand. I have only had one die since I began to collect them last summer.'

"'Then you have kept them a year; they ought to have turned into fairies.'

"'I suppose many of them have. Of course I let out all those that have been with me twelve months—they don't turn to fairies in the cage, you know. Now I have only those I caught this year or last autumn; the prettiest don't appear till the autumn.'"

Another butterfly which is common on the Continent, is the Scarce Swallow-tail (*Papilio podalirius*, Plate I., fig. 1), which is said by some of the older writers on Entomology to have been found in England; but as it has not been seen for many years, it is not now regarded as a British species. In France it is called "La Flambé," the Flame butterfly, and in Germany "Segelfalter," or Sail butterfly, on account of its

broad streaked wings. The caterpillar is of a different shape to that of *P. machaon*, being thickest in the middle. It is green, dotted with red, and with oblique yellowish streaks, and feeds, not on *Umbelliferæ*, but on fruit and fruit trees, and the butterfly is found flying about bushes, and settling on the leaves, and is much less easy to capture than *P. machaon*.

THE WHITE MOUNTAIN BUTTERFLIES

From Norway, and the Spanish Sierra Nevada in the west, to Kamtchatka, and the Rocky Mountains of America to the east, and in the Himalayas up to an elevation of, perhaps, 20,000 feet, we may find many species of satiny-white butterflies, with black spots on the fore wings, and generally with round red spots, ringed with black, on the hind wings. They are particularly numerous in Central Asia, and their caterpillars are velvety black, with red or yellow spots, and orange or yellow retractile forks on the neck, like those found in the caterpillars of *Papilio*. They feed on various kinds of saxifrages and other alpine plants. The best-known species is *Parnassius apollo* (Plate 1, fig. 3), which is common in summer in the beautiful flowery meadows of the Lower Alps, which swarm with butterflies of all descriptions. It is found in most of the other mountain ranges of Europe and Asia, but not in those of England or Scotland, though it might reasonably be expected to be found there, as was erroneously stated by some of the older writers on British Entomology. Another less common Swiss species, representing a different section of the genus, is *Parnassius mnemosyne*, which has no red spots on the hind wings.

In Topelius' story of "The Wood Anemone" in his "Fairy Tales from Finland," we read, "The name of the largest butterfly was Apollo, and he had white wings with yellow spots on them." I have not seen the original, and the "yellow" spots, which should read "red," may be a mistranslation; but the frontispiece to the English edition represents quite recognisably the *female* of the Large White Cabbage Butterfly. Probably the English editor supposed that *Apollo* was a mere fancy name, which had been used at random.

THE WHITE AND YELLOW BUTTERFLIES OF OUR FIELDS AND GARDENS

These are butterflies which resemble the Swallow-tails in many of their characters; but the wings are generally rounded,

and the caterpillars have no retractile fleshy fork on the neck. Of late years most kinds of butterflies have been becoming scarcer and scarcer in England, but the White Butterflies are an exception, and there is scarcely an open space, even in London, where we cannot see the Large and Small White Cabbage Butterflies flying about, almost any day during the spring and summer. These butterflies (*Pieris brassicæ* and *P. rapæ* [Plate 1, fig. 5]), belong to a family called *Pieridæ*. They are very similar, but *P. brassicæ* is a larger butterfly, with blacker markings than the other; the females of both species may be known by having more black spots on the upper surface of the fore wings than the males. The caterpillars feed on cabbage, Indian Cress (*Tropæoleum*, improperly called Nasturtium as a garden plant), and many other wild and cultivated plants and are often very destructive in vegetable and flower gardens. These caterpillars are green, streaked with yellow, and the yellowish black-dotted chrysalis may often be seen fixed to walls or palings. Very frequently, too, we may notice a dead caterpillar lying in the midst of a cluster of little yellow cocoons, not unlike those of a silkworm in miniature. These are produced by the grubs of a small ichneumon fly, which have eaten up the body of the caterpillar during its lifetime.

Extending our walks to the lanes and meadows, we shall find a third common species of *Pieris*, the Green-veined White Butterfly (*P. napi*, Plate 2, fig. 1), which is very like the Small White Butterfly, but has the hind wing broadly streaked with greenish beneath. There is a smoky grey variety of the female of this butterfly (*Pieris napi*, var. *bryoniæ*) which is not uncommon in the Alps, though scarce and local in the British Islands.

One of the prettiest of our spring butterflies is the Orange Tip (*Euchloë cardamines*, Plate 2, fig. 2), the male of which is marked with a bright orange spot on the fore wings. Similarly coloured butterflies belonging to different genera are found in most parts of the world, the largest, inhabiting the East Indies, being three or four inches across the wings. There are several other species of the genus *Euchloë* found on the Continent; some of which are yellow. In some species the orange spot is only found in the male, as in our species; in others it is absent in both sexes; but in many allied foreign genera it is present in both. The under surface of the hind wings of our Orange Tip is prettily mottled with green and white, and when the butterfly is resting on tall Umbelliferous plants, as it is in the

habit of doing, it draws down its fore wings till the orange spot is covered by the raised hind wings, and nothing is visible but the mottled green hind wings, and the similarly coloured tip of the under side of the fore wings beyond the orange, when the butterfly so closely resembles the colour of the plant on which it is resting, as to be difficult of detection. The butterfly is common in lanes and meadows, and dwarf specimens, about half the usual size, are sometimes met with in the South of England. The caterpillar is slender, green, slightly pubescent, and feeds on *Cardamine impatiens* (Bitter Cress) and other Cruciferous plants, preferring the seeds. The chrysalis is different in shape to those of the Cabbage White Butterflies, being thickest in the middle, and coming to a sharp point at both ends.

The female of the Orange Tip, which is destitute of the conspicuous orange blotch on the fore wings in the male, has sometimes been mistaken for the Bath White Butterfly (*Pieris daplidice*). But the Bath White is larger, and has a black white-spotted band bordering the front half of the fore wings, and the green mottling of the under side of the hind wings is duller than in the Orange Tip. The Bath White is a very rare butterfly in England, though common on the Continent, but is sometimes found settling on flowers in waste places or stubble fields in summer and autumn. In the Alps a very similar species is met with, called *Pieris callidice*, which may be distinguished by the under side of the hind wings being marked with white sagittate (arrow-headed) spots.

There is a rather small butterfly known as the Wood White (*Leucophasia sinapis*) allied to the Orange Tip, but with larger and narrower wings; pure white above, with an ashy spot at the tip of the fore wings. It flies weakly at the edges of woods but is much less common in England than formerly. The caterpillar is green, with a whitish or yellowish longitudinal line on the sides, and the chrysalis is green, with pink lines, slender, and pointed at both ends. The caterpillar feeds on various species of vetch, etc.

It is curious how many insects that feed on common plants are extremely rare, especially in England, though many of them are abundant on the Continent, while others, though restricted in their food, are much more abundant. The protection of birds is perhaps one of the most probable explanations.

The largest of our White Butterflies, the Black-veined White (*Aporia crataegi*, Plate 1, fig. 4), is rather larger than the Large

Cabbage White, and has slender black nervures on the wings, but no distinct black spots.

Though common and generally distributed in England a century ago, the butterfly has since become rarer and rarer, dying out in one locality after another where it was formerly abundant, till it is now extinct unless it may perhaps still linger in some parts of Kent. There is only one brood in the year, in early summer, which only remains on the wing for a short time, and the butterfly generally frequents open places near woods. The caterpillar is blackish, clothed with whitish hairs, and has two reddish longitudinal streaks. The caterpillars feed gregariously on hawthorn, plum, and other trees on the Continent, where they are often destructive, though somewhat uncertain in appearance. The chrysalis is shaped as in the Cabbage Butterflies.

THE RED-HORNED BUTTERFLIES

The Brimstone Butterfly is always one of the earliest butterflies to appear in spring, and it remains with us till late autumn. Unlike many butterflies (such as the Swallow-tail, which is often more or less broken when captured on the wing), the Brimstone is nearly always in good condition, for the texture of its wings is unusually strong. The Brimstone Butterfly (*Gonepteryx rhamni*, Plate 2, fig. 5 (male)) is about two inches in expanse, and may be recognised at once by the uniform sulphur-yellow colouring of the male, and the greenish white colour of the female. In the middle of each wing is a small orange spot, and the hind wings have an angular projection on the middle of the hind border, which is the only rudiment of a tail in any British species of the sub-family *Pierinæ*.

On the shores of the Mediterranean a closely allied but still more beautiful species (*G. cleopatra*) is found, in which the fore wings of the male are reddish orange, except on the borders.

The Brimstone Butterfly is common in England, especially towards the south, frequenting open woods, where its slender green caterpillar feeds on buckthorn. This is *the* "Butterfly" *par excellence*, *i.e.* the Butter-coloured Fly, for it has lately been suggested that this is the derivation of the word, a far more probable supposition than that the word means "the fly that appears in the butter season," as some of the earlier Entomologists conjectured.

The antennæ of the Brimstone Butterfly are short, thick, and reddish, *not* long, slender, and black or grey, as in the White Butterflies, to which otherwise the Yellow Butterflies are closely allied. Hence this and the Clouded Yellows, which have somewhat similar antennæ, have been called Red-horned Butterflies by some writers. The Clouded Yellows can, however, be distinguished at once from the Brimstone by their rounded wings. We have two species in England, representing different sections of the genus. They are found in clover fields and meadows, and, unlike most butterflies, are commoner in England than used to be the case years ago. The Clouded Yellow (*Colias edusa*) is a butterfly of extremely rapid flight, and it is very conspicuous on the wing. It generally flies low, and occasionally settles on a flower, when the bright green of the under surface of the hind wings becomes visible. The black border of the wings is veined with yellow in the male, and spotted with yellow in the female. It is very uncertain in appearance, but is most common on the South Coast in late summer and autumn. It is a rather variable species, and the female, sometimes exhibits a pale yellowish or whitish form, known as *Colias helice*. The caterpillar is green, and feeds on clover, trefoil, etc.

Butterflies closely allied to *C. edusa* are found throughout Europe, Asia, and North America, as well as in both North and South Africa. Several of these species are flushed with purple over the orange, sometimes so dark as to be nearly black. We have figured an eastern European species, the Dark Clouded Yellow (*C. myrmidone*, Plate 2, fig. 4), which has orange-coloured wings like *C. hyale*, but with a narrower black margin, and usually no yellow nervures in the male. *Colias aurora*, a Central Asian species twice the size of our *edusa*, can fly as fast as a horse can gallop.

The Pale Clouded Yellow (*Colias hyale*, Plate 2, fig. 3) is of a whitish or yellow colour, and is a much rarer species in England than *edusa*, and equally uncertain in appearance. On the Continent it is frequently as abundant as the White Butterflies, which it resembles in its habits, and its flight is much less rapid than that of the Clouded Yellow. The caterpillar is green with yellow longitudinal stripes on the sides; it feeds on clover, etc.

Butterflies of the genus *Colias* are found in nearly all parts of the world, even as far as South America and South Africa, and are specially characteristic of Alpine and Arctic regions,

and in some species, as in the Alpine *C. phicomone*, the usual yellow colour shades into dull green, a rather unusual colour for the upper side of butterflies, though commoner on the under surface of various species.

It was probably a Brimstone Butterfly or a Clouded Yellow which Shakespeare had in his mind when he gave us a painful picture of schoolboy hooliganism in "Coriolanus" (Act I, Scene 3): "He has such a confirmed countenance. I saw him run after a gilded butterfly; and when he caught it, he let it go again: and after it again; and over and over he comes, and up again; catched it again: or whether his fall enraged him, or how 'twas, he did so set his teeth, and tear it; O, I warrant, how he mammocked it!"

MONARCH AND FRITILLARY BUTTERFLIES

The great family *Nymphalidæ* contains all our larger butterflies except the White and Yellow ones. They are generally of rich or variegated colours, or else of some shade of brown, and are distinguished by having the front legs rudimentary in both sexes, and generally hairy; whence they have been called Brush-footed Butterflies. Nearly half the known butterflies of the world fall into the *Nymphalidæ*, and they are divided into several sections, many of which are not British, nor even European; but six very distinct groups are represented in Europe, the Danaids, the Fritillaries, the Angle-Wings, the White Admirals, the Emperors, and the Satyrids.

In the *Papilionidæ* and *Pieridæ*, which many Entomologists consider to be merely entitled to rank as sub-families rather than as distinct families, the chrysalis is generally attached by the tail, and held in an upright position by a silken cord round the middle of the body, and the caterpillars are smooth or downy. But in the *Nymphalidæ* the chrysalis is generally suspended freely by the tail to a small button of silk, and the caterpillars are frequently bristly, or, if smooth, generally have a forked tail.

The Danaids only require short mention here. The only two which need be referred to are large tawny butterflies, with a conspicuous black patch of scales on the middle of the hind wings in the males; and the caterpillars have two or three pairs of long fleshy filaments on their bodies. *Limnas chrysippus*, a common Indian and African species, about three inches in expanse, and with a large black, white-banded

patch at the tip of the fore wings, extends to Greece; and a still larger North American species, with a narrow white-dotted border to the wings, the Monarch (*Danaus plexippus*) has been taken several times in England and in other parts of Western Europe but is certainly a mere accidental importation.

The caterpillars feed on various species of *Aristolochia* (Milk-weed), none of which are actually indigenous in England. The Monarch is common throughout North America, and is gregarious and migratory; and during the last fifty or sixty years has extended its range over a large part of the Pacific Islands, and in all probability will sooner or later spread over Southern Asia and perhaps large parts of Africa as well. Whether it will ultimately establish itself permanently as a British species will probably depend on whether it is able to find a food plant upon which the caterpillar can feed. Among the principal countries where it has been noticed outside Europe and America are the Canaries, Hawaii, Australia, New Zealand, and Java.

The Fritillaries are an extensive group of large or moderate-sized butterflies, generally of a tawny colour on the upper surface of the wings, with numerous black spots or lines. The under surface of the wings is marked with pale spots, often silvered, or is ornamented with green or purple spots, blotches, or streaks. The butterflies derive their name from a tulip-like flower called the Fritillary, which grows in damp meadows, and is similarly spotted with black, though the purple colour of the flower is very different from the tawny colour of the Fritillary Butterflies. But there is no doubt that both the butterflies and the flower were much commoner in England when the butterflies were first called Fritillaries than at the present day.

The caterpillars of the Fritillary Butterflies are black, brown, or grey, more rarely reddish or greenish, with numerous short spines, and they feed on low plants, such as wild geranium, plantain, and (in the case of the silver-spotted species) especially on violets.

The three British Fritillaries without silver spots on the under surface were all formerly common round London, and in other parts of the British Islands; but are now very local, being easily exterminated by cultivation. The Greasy Fritillary (*Melitæa aurinia*, or *M. artemis*, as it is otherwise called) is generally found in damp meadows. The wings are reddish fulvous above, with yellow spots and black lines and markings,

and the under surface of the hind wings is of a peculiar pale glossy yellow. The caterpillars, which are black with white dots, feed on scabious, plantain, foxglove, etc., and are gregarious when young, but afterwards scatter in different directions in search of food. The butterflies, like all the smaller Fritillaries, appear in spring or early summer, and are gregarious.

The Glanville Fritillary (*Melitæa cinxia*, Plate 4, fig. 2), named after Lady Glanville, of whom we have spoken in our introduction (*antea*, p. 33), is now one of the species least often met with in England. Formerly it was not uncommon as near London as Dulwich, as well as at many places on the South Coast; but at present it does not appear to have been seen for many years elsewhere than in the Isle of Wight, where it still lingers on rough ground near the sea. This butterfly is found in dry windy places. The caterpillar, which is black dotted with bluish white, feeds on plantain, hawk-weed, etc. The chrysalis is greyish white with rows of tiny orange tubercles. The Glanville Fritillary may be distinguished from the other British species by the hind wings being marked with numerous distinct black spots beneath.

There are, however, many European species similarly marked on the under surface with conspicuous black spots. One of the commonest and handsomest of these is *Melitæa didyma*, which is of a reddish fulvous colour above, and is marked with round black spots on the upper surface as well as the lower, which gives it the appearance of a Pearl-bordered Fritillary (*Brenthis*) rather than a *Melitæa*. The slate-coloured caterpillar feeds on plantain, etc. The butterfly is found in meadows.

The Heath Fritillary, or the Pearl-bordered Likeness Fritillary (*Melitæa athalia*, Plate 4, fig. 3) is still common in many places in Britain on heather and in open woods, though it has latterly been much persecuted, and in some localities apparently exterminated by collectors. The under surface is tessellated with yellow and reddish, separated with black lines, but there are no black spots. The black caterpillars feed on various low plants, especially *Melampyrum* (cow-wheat), and live under a common web when young. It is a very variable species, and there are a great number of allied species or varieties met with on the Continent, which are an extremely difficult study.

On the Continent of Europe and in Northern and Central Asia many more species are found, belonging to the three

groups represented by our British species. In some of them the wings are of a prevailingly black colour, as in *Melitæa dictynna*, a common Continental species, in which the tawny markings on the upper surface are reduced to rows of more or less numerous spots.

A more remarkable species is *Melitæa cynthia*, the female of which is brownish yellow, lined with black, but the male is black, with extensive white markings, with rows of red spots towards the borders of the wings, and a few red spots on the under surface. This and other small Fritillaries are found commonly flying over rhododendrons in the Alps. The caterpillar, which is black with yellow lines, feeds on plantain.

Another handsome species, not found in the British Isles, is *Melitæa maturna* (Plate 4, fig. 1), which is blackish brown, with a reddish orange band on the margins of the wings and pale yellow and orange spots. The under surface is orange-red, with a pale yellow central band on the hind wings intersected by a fine black line. Along the edges of the wings is a row of pale yellow lunules; at the base of the hind wings are five spots of the same colour. It is common in meadows near woods in many parts of Central Europe and Asia. The caterpillar is black with yellow spots arranged in rows. It feeds on plantain, scabious, &c.

The Fritillaries with silver, purple, or green on the under surface of the wings fall into two groups, the smaller species and the larger. Of the smaller species we have only two in Britain—the Pearl-bordered Fritillary (*Brenthis euphrosyne*) and the Small Pearl-bordered Fritillary (*Brenthis selene*, Plate 4, fig. 5). They are common in open woods, and in meadows near woods in spring, and the caterpillars which feed on dog-violet are black with red prolegs. The upper surface of the wings is very similar in both species, but *Brenthis selene* is more yellow on the under side of the hind wings, and the pale spots are more numerous and brighter silvery. They are often common in the same woods, *Brenthis euphrosyne* appearing a few days earlier than *B. selene;* but there is a small wood near Brighton where *B. selene* used to be common, but where I never saw the other species. On the Continent they are double-brooded, and *B. selene* is very abundant in the autumn.

A butterfly, not unlike *Brenthis selene*, but smaller, and more purple on the under side of the hind wings, is common on the Continent, and is said to have been sometimes found in England. It is called Weaver's Fritillary (*Brenthis dia*). Another similar

species, which is found in swampy meadows in Central Europe, is *B. aphirape*. It has the under side of the hind wings reddish yellow, with a central band formed of irregular spots, a row of marginal spots forming angles pointing inwards, and between the two a series of shining spots. All the spots are pale yellow in the male, and white in the female, with a silvery lustre. They are edged with black in both sexes.

There are several other allied Continental species, especially in the Alpine and Sub-Arctic regions.

The rarest of the British Fritillaries is the Queen of Spain (*Argynnis lathonia*), which measures about two inches across the wings; these are rich fulvous above, with black spots, and the fore wings are somewhat produced at the tips, with the hind margin slightly concave. Beneath the wings are paler, and the hind wings and the tip of the fore wings are crowded with large silvery spots, many of which are oval or linear. The brown caterpillar feeds on heartsease. The butterfly is always rare in England, though it is met with occasionally in the south, in clover fields and flowery meadows. On the wing it has some resemblance to the Wall Brown Butterfly (*Satyrus megæra*, Plate 5, fig. 8), which is often found in its company on the Continent, where it is very common. Its range extends to India, where a scarcely differing local form, called *Argynnis issæa*, is found in the Himalayas, along with other species; one of them, *Argynnis childrenæ*, being a very large Fritillary, magnificently striped with silver on the under surface of the hind wings. Another and commoner Indian butterfly, *Argynnis niphe*, is tawny above, with black spots, and the female is blackish towards the tips of the fore wings, with a white oblique band, giving it a superficial resemblance (shared by several other African and Asiatic butterflies, especially females, and even by some moths) to *Limnas chrysippus*, a butterfly to which we have already alluded, and which belongs to a group which is seldom attacked by birds, to which it appears to be extremely distasteful. This is one of the best-known instances of the curious and interesting phenomenon known as protective resemblance, it being supposed that insects superficially resembling others which are distasteful to birds share in their immunity. But it is still uncertain how far similarity of colouration in insects is due to natural selection, and how far to similarity of environment.

The Dark Green Fritillary (*Argynnis aglaia*, Plate 4, fig. 6) is common on heaths in many places, and may be recognised by

the hind wings, which are green beneath, with large round silvery spots. There are also several silvery spots towards the tip of the fore wings beneath. The caterpillar is blackish, with yellow lines on the back, and reddish spots on the sides. Another butterfly, known as the High Brown Fritillary (*Argynnis adippe*), is very similar to this, but the under surface is more yellow, and the tip of the fore wings is yellowish, marked with only two silver spots (or none). This butterfly is found in woods, and the greenish caterpillar feeds on violet and heartsease.

The Silver-washed Fritillary (*Argynnis paphia*, Plate 4, fig. 7) is common in woods, and is fond of settling on the flowers of the bramble, where it is not always easy to catch it without entangling the net. The hind wings are green beneath, streaked with silver, and in the male, the fore wings are marked above with black lines along the longitudinal nervures. The caterpillar is brown, with yellowish lines, and feeds on dog violet.

Another large species of *Argynnis*, *A. laodice*, is common in Eastern Europe, but is not found in the West. The hind wings are yellowish beneath, divided from the dark purple outer portion of the wing by a slightly silvery band.

Here we may perhaps mention the Duke of Burgundy Fritillary (*Nemeobius lucina*, Plate 6, fig. 4), which, though it does not belong to the same group as the true Fritillaries, is the only European representative of a distinct family of butterflies, the *Nemeobiidæ*, in which the front pair of legs of the male are imperfectly developed, but perfect in the female. The fore wings, which only measure an inch and a quarter in expanse, are brown, with three rows of orange spots, and the marginal row is continued round the hind wings, between which and the base are a few scattered orange spots. The hind wings are reddish brown beneath, with two rows of white spots. The butterfly flies in open woods and bushy places. It is a rather local species in England. The caterpillar is reddish brown with black dots on the back; it feeds at night on primrose, cowslip and sorrel, and hides during the day under the food plant. The chrysalis is ochreous brown with black dots and grey pubescence.

THE ANGLE-WINGED BUTTERFLIES

The Angle-winged Butterflies are among the handsomest and best known of our larger British species, though even these

are much less common in England than formerly. Their wings, though not actually tailed, are dentated, and the outline is more or less irregular, with projections on the margins. The caterpillars are spiny, often gregarious, and feed on nettles, thistles, and various trees. As these butterflies are so well known, we will pass them over briefly.

The Small Tortoiseshell (*Vanessa urticæ*, Plate 3, fig. 4) and the Peacock Butterfly (*V. io*, Plate 3, fig. 3) are both found frequently on nettles, and are common in many places in weedy lanes, and are also often seen in gardens. The caterpillar of the Small Tortoiseshell is yellowish, whereas that of the Peacock is black. They feed on nettle and hop.

Two other species frequent lanes and hedgerows: the Large Tortoiseshell (*Vanessa polychloros*, Plate 3, fig. 5) is not uncommon in the South of England, and its caterpillar feeds on elm. The Comma Butterfly (*Vanessa c-album*, Plate 3, fig. 7) may be known by its strongly dentated tawny brown-spotted wings, which look almost ragged; and by the white C-shaped mark on the under side of the hind wings, which may be dark yellowish or greenish. The caterpillar feeds on hop, nettle, currant, etc., and the butterfly is now very local in England, though formerly widely distributed and common. It is in the habit of flying along hedges, and occasionally settling.

Several species allied to the Large Tortoiseshell are found in Eastern Europe; there is a second species of Comma in Southern Europe, and allied species are numerous in North America. The Peacock Butterfly has no near ally in any part of the world; its range extends to Japan and to Sicily, but not further. The dark under surface of the wings, however, resembles that of the Camberwell Beauty (*Vanessa antiopa*, Plate 3, fig. 6), the rarest British species of the Angle-winged Butterflies; but though always rare and uncertain in appearance, it may be found occasionally all over the country. It is a large chocolate-brown butterfly, with a broad border to all the wings, which varies in colour from nearly white to a rather deep yellow; within this is a row of blue spots. The border is whitest in British specimens, and perhaps yellowest in American ones. The caterpillar feeds chiefly on willow, and hence the butterfly is often found near river-banks. Like the Red Admiral, it is fond of settling on fruit.

The Red Admiral (*Pyrameis atalanta*, Plate 3, fig. 1) is a black butterfly, with a red band across the fore wings and white

spots towards the tip, and a red border to the hind wings. It is found in lanes and gardens, and is at present perhaps the commonest species in England, being frequently met with in many places round London, etc., where even the Small Tortoise-shell is seldom or never seen. It is evidently to the Red Admiral that Coventry Patmore alludes, in the following lines :—

"She brought me 'Wiltshire Butterflies,'
The Prize-book; then we paced the lawn,
Close-cut, and with geranium-plots,
A rival glow of green and red;
Then counted sixty apricots
On one small tree; the gold-fish fed;
And watch'd where, black with scarlet tans,
Proud Psyche stood and flash'd like flame,
Showing and shutting splendid fans,
And in the prize we found its name."

(The Angel in the House: The Morning Call. (2))

The Red Admiral is often found on waste ground in company with the Painted Lady (*Pyrameis cardui*, Plate 3, fig. 2). The latter is sometimes common in the British Islands, though not always equally abundant. Like the Red Admiral and the Camberwell Beauty, it is found throughout the Northern Hemisphere, being equally common in Europe and North America; but in addition to this, the Painted Lady is a migrating and cosmopolitan butterfly, being found in nearly all parts of the world. In its migrations it is sometimes accompanied in Europe by a migrating Dragonfly (*Leptetrum quadrimaculatum*) and by other insects. The caterpillar is dark grey with yellow spines and markings. It feeds on thistle.

Comparatively few artists have turned their attention to Entomology from the point of view of art, and an artist, as such, unless he has some knowledge of Entomology, is often unfitted to draw insects, as he does not understand technicalities, and tries to improve upon his pattern. In fact, an artist requires a special training before he can succeed in this department.

Some men, however, have succeeded in combining artistic pursuits with Entomology, as, for instance, the miniature painter, Roesel von Rosenhof of Nuremberg, in the middle of the eighteenth century; and a little later Jacob Hübner, the cotton-designer of Augsburg, whose drawings of insects, to say the least, are fully up to the average of similar work at the present day.

There is a pretty story told of the Swiss artist Fuseli, who

lived in England, and whose brother (known as Fuessly) was a distinguished Entomologist. He was once about to make a drawing of a sylph, and a friend suggested that he should give her butterfly's wings. "That is a good idea," said Fuseli, "and to be correct, I will paint the wings from the butterfly itself." So he went out and caught a Peacock Butterfly, and began to work, but he did not complete the task at once, and when he went to resume it next day he found that the specimen had been swept away. He went out to find another specimen to repair the loss, and this time he caught a Small Tortoiseshell Butterfly, and was so delighted with the beautiful colours and patterns that he became an ardent Entomologist, and used to say that no one could imagine how much he had learned from the study of the colours of butterflies.

In some of the oldest English books on butterflies, we find a representation of a butterfly of this group, which Petiver called "Albin's Hampstead Eye, where it was taken by this curious person, and is the only one I have yet seen." It is a butterfly rather smaller than the Small Tortoiseshell, and remarkable for the many large eye-spots on both the fore and hind wings. It is not a European butterfly at all, but belongs to the East Indian genus *Junonia*, and was probably brought from some island in the Eastern Archipelago at a time when, as a reviewer of books of travel once wrote, "half the world was undiscovered and the other half was unknown." It was probably given to Albin, who put it in his collection, and Petiver, finding it there, supposed, for some reason, that Albin himself had captured the specimen at Hampstead. This interesting butterfly is now known as *Junonia velleda*. Errors in the localities of butterflies, etc., were very numerous, but very excusable among the older Entomologists, and are still liable to be committed even at the present day. Mr. R. Trimen told me that on visiting a South African Exhibition in London some years ago he found in an ostensibly representative series three common British butterflies that could not have been captured in South Africa at all.

PURPLE EMPERORS AND WHITE ADMIRALS

One of the largest and handsomest of our British Butterflies is "The Purple Emperor of the British Oak," or, as he was called by some older writers, "The Emperor of Morocco" (see *antea*, p. 30).

If we are wandering through large woods in the Southern or Midland Counties of England about midsummer, we may sometimes see several very large dark butterflies with a rich purple lustre flying round and over some lofty tree, well exposed to the sunlight, and occasionally settling on a branch far out of reach. These are specimens of the Purple Emperor (*Apatura iris*, Plate 2, fig. 6), our only British representative of the sub-family *Apaturinæ*, the group which it represents. Although the butterfly usually flies about high trees, it will occasionally settle on the ground to sip water from a puddle; or it may be attracted by carrion or filth, a habit hardly shared by any other British butterfly, though frequent among exotic *Nymphalidæ*. On the Continent strongly smelling cheese is used to attract such butterflies, but I have not heard of this having been tried in England. Although the males delight in sporting about high trees, the females lay their eggs on poplar and sallow, especially the latter. The caterpillar is slug-shaped, green, with yellow stripes, and with two long horns on the head; and the head of the pupa is also bifid.

The habits of the Purple Emperor have been well described by Haworth in his "Lepidoptera Britannica," published as long ago as 1803 (p. 19):—

"This purple Emperor of the British oaks is not undeservedly the greatest favourite of our English Aurelians. In his manners likewise, as well as in the varying lustres of his purple plumes, he possesses the strongest claims to their personal attention.

"In the month of July he makes his appearance in the winged state, and invariably fixes his throne upon the summit of a lofty oak, from the utmost sprigs of which, on sunny days, he performs his aërial excursions; and in these, ascends to a much greater elevation than any other insect I have ever seen, sometimes mounting higher than the eye can follow; especially if he happens to quarrel with *another Emperor*, the monarch of some neighbouring oak: they never meet without a battle, flying upwards all the while, and combating with each other as much as possible; after which they will frequently return again to the identical sprigs from which they ascended." [Many other *Nymphalidæ* are in the habit of selecting a particular perch, to which they will constantly return, even if driven away.] "The wings of this fine species are of a stronger texture than those of any other in Britain, and more calculated for that gay and powerful flight which is so much admired by

entomologists. The purple Emperor commences his aërial movements from ten to twelve o'clock in the morning, but does not perform his loftiest flights till noon, decreasing them after this hour, until he quite ceases to fly about five in the afternoon: thus emulating the motions of that source of all his strength, the sun. The females, like those of many other species, are very rarely seen on the wing: the reason of which is both interesting and but little known. It is their being destitute of a certain *spiral socket*, which the males possess near the base of the main tendon of their upper wings; which *socket* receives and works a strong elastic *spring*, arising from the base of the under wings; thereby enabling them to perform a stronger, longer, and more easy flight than it is possible for the females to do. Moses Harris, I believe, was the first who discovered and published figures of this *socket* and *spring*, in an ingenious but little-known work, called '*An Essay preceding a Supplement to the Aurelian, wherein are considered the Tendons and Membranes of the Wings of Butterflies*,' where he tells us (p. 12) 'the females are not met with on the wing so often as the *males*, some of which are very plentiful, but the *females* rare to be seen; of which the *purple Emperor* is one capital instance. I have been informed Mr. Whitworth caught thirteen in one day, and but one *female* amongst them.'

"I can readily credit this, for in three days I took myself twenty-three (nine of them in one day), but never took a female at all. The males usually fly very high, and are only to be taken by a bag-net fixed to the end of a rod twenty or thirty feet long. There have been instances, though very rare, of their settling on the ground near puddles of water, and being taken there. When the purple Emperor is within reach, no fly is more easily taken than him; for he is so very bold and fearless, that he will not move from his settling place until you quite push him off: you may even tip the ends of his wings, and be suffered to strike again."

I have quoted this passage in its entirety, but it is necessary to explain that neither the Purple Emperor nor any other butterfly (with one or two doubtful exceptions) possesses the frenulum or "spring," above described, though such a structure exists in many of the larger *moths*. It has been suggested to me that there may have been confusion between the Purple Emperor Butterfly and the Emperor Moth; and Harris, whom Haworth quoted, correctly states, in the original passage,

that the structure to which he refers is found only in moths, and not in butterflies.

There is another species closely allied to this, which is common on the Continent, but is not British. This is the Small Purple Emperor (*Apatura ilia*), which may be distinguished by having an ocellated spot near the hinder angle of the fore wings, on the upper surface, as well as beneath. The caterpillar, which feeds on poplar and sallow, is rather duller green than that of *A. iris*. Unlike our Purple Emperor, *A. Ilia* is a very variable species, and orange-yellow varieties, or varieties with dull orange instead of white markings, are frequently met with.

The Poplar Butterfly (*Limenitis populi*, Plate 2, fig. 7) is larger than the Purple Emperor. It is not found in England, though it has been indicated as British by some early writers, who appear to have marked several well-known butterflies as British, without the least authority, or even any report of their having been taken in Britain. The Poplar Butterfly belongs to the sub-family *Nymphalinæ*, in which the wings are rounded or angulated; and the caterpillars are more or less spiny; but their heads are not bowed as in the *Apaturinæ*, nor their tails bifid as in the *Satyrinæ*. The caterpillar of the Poplar Butterfly feeds on poplar and aspen. It is yellowish green, with red head and legs, and the front segments of the body reddish violet.

The White Admiral (*Limenitis camilla*) is a very conspicuous butterfly on the wing, flying along hedges and the borders of open spaces in woods, in various localities, chiefly in the South of England, but it is now very local. The green spiny caterpillar feeds on honeysuckle. By many writers this insect is called *Limenitis sibylla*, the name *camilla* being applied to an allied Continental species, otherwise known as *L. drusilla*.

In Haworth's time the White Admiral was common, even close to London; he writes as follows: "The graceful elegance displayed by this charming species when sailing on the wing, is greater perhaps than can be found in any other we have in Britain. There was an old Aurelian of London, so highly delighted at the inimitable flight of Camilla that long after he was unable to pursue her, he used to go to the woods, and sit on a stile, for the sole purpose of feasting his eyes on her charming evolutions" (Haworth, "Lepidoptera Britannica," p. 30).

Years ago many of the Spitalfields weavers used to be

enthusiastic entomologists, and this old man may well have been one of them.

Crabbe has written of the weaver as an Entomologist in Letter VIII. of "The Borough," published in 1860, and has brought several of our most beautiful butterflies into his verses; the Purple Emperor, the White Admiral, the Silver-washed Fritillary, and the Clifden Blue; as well as a Sphinx, probably the Humming-bird Hawk-moth, or possibly the Convolvulus Hawk-moth.

"There is my friend the Weaver; strong desires
Reign in his breast, 'tis beauty he admires:
See! to the shady grove he wings his way,
And feels in hope the raptures of the day—
Eager he looks; and soon, to glad his eyes,
From the sweet bower, by nature formed, arise
Bright troops of virgin moths and fresh-born butterflies;
Who broke that morning from their half year's sleep,
To fly o'er flowers where they were wont to creep.
Above the sovereign oak, a sovereign skims,
The Purple Emp'ror, strong in wing and limbs;
There fair Camilla takes her flight serene,
Adonis blue, and Paphia, silver-queen;
With every filmy fly from mead and bower,
And hungry Sphinx who threads the honey'd flower;
She o'er the Larkspur's bed, where sweets abound,
Views ev'ry bell, and hums th' approving sound,
Poised on her busy plumes, with feeling nice.
She draws from every flower, nor tries a floret twice.
He fears no bailiff's wrath, no baron's blame,
His is untaxed and undisputed game.
No less the place of curious plant he knows,
He both his Fauna and his Flora shows."

These lines have served to keep the memory of Crabbe green among Entomologists, who would otherwise, perhaps, have been ignorant of his existence. It is a curious coincidence that one of the earliest professional collectors of British Butterflies and Moths for sale was named Richard Weaver. He lived at Birmingham in the first half of the nineteenth century.

When Crabbe wrote, a hundred years ago, butterflies were far more abundant in England than at present; but at that time collectors, if they went far afield, might have had to face the danger of man-traps and spring-guns, in addition to the still existing dangers of being accused of trespassing, either simply or on suspicion of making Entomology a pretext for poaching, as in the story related by Charles Kingsley in "Glaucus," in 1855:—

"You cannot deny, I say, that there is a fascination in this same Natural History. For do not you, the London

merchant, recollect how but last summer your douce and portly head-clerk was seized by two keepers in the act of wandering in Epping Forest at dead of night, with a dark lantern, a jar of strange sweet compound, and innumerable pocketsful of pill-boxes, and found it very difficult to make either his captors or you believe that he was neither going to burn wheat-ricks, or poison pheasants, but was simply 'sugaring the trees for moths,' as a blameless entomologist? And when, in self-justification, he took you to his house in Islington, and showed you the glazed and corked drawers full of delicate insects, which had evidently cost him in the collecting the spare hours of many busy years, and many a pound too, out of his small salary, were you not a little puzzled to make out what spell there could be in those 'useless' moths, to draw out of his warm bed, twenty miles down the Eastern Counties Railway, and into the damp forest like a deer-stealer, a sober white-headed Tim Linkinwater like him, your very best man of business, given to the reading of Scotch political economy, and gifted with peculiarly clear notions on the currency question?

"It is puzzling, truly."

There are a great number of butterflies allied to the White Admiral, with a longitudinal and frequently interrupted white or tawny bar, running from the base of the fore wings, followed by a curved band of the same colour, generally broken on the fore wings, and entire on the hind wings. Such butterflies are very numerous in Africa and the East Indies, and their wings are generally more rounded than in our White Admiral. One or two black species with white markings, belonging to this series, are met with in South-Eastern Europe, the commonest of which is the Indian Admiral (*Neptis aceris*, Plate 2, fig. 8). The caterpillar, which is reddish brown, feeds on *Orobus* (Bitter Vetch).

THE BROWN BUTTERFLIES OF OUR WOODS AND FIELDS

Many species of moderate-sized butterflies, generally of a brown colour more or less varied with red or tawny, are common in most places in the country in summer; though, for some unexplained reason, they seem to have become unusually scarce round London, as well as in some parts of Yorkshire, etc., of late years. These butterflies belong to the family *Nymphalidæ*, sub-family *Satyrinæ*, in which the first pair of legs is rudimentary, especially in the males, and the wings are rounded

or slightly dentated, and almost always marked, especially beneath, with a variable number of round black spots, called "eyes," generally enclosed in a pale ring, and marked with a white dot in the centre.

It is hardly necessary to describe the caterpillars in detail; they are smooth or downy, and occasionally set with very fine bristles, but they are not spiny. They are always more or less green in colour, and have a forked tail; they feed on different kinds of grasses.

Several of these butterflies are found in meadows, the commonest of all being the Meadow Brown (*Epinephile janira* or *jurtina*, Plate 6, fig. 1), which flits about in hayfields, along hedges, and wherever long grass grows, at midsummer, settling frequently on flowers. It is brown above, with an eye-spot towards the tip of the fore wings, which, in the female, is placed on the upper part of a more or less extended tawny band, parallel to the hind margin of the wing. But even this, which is certainly one of our commonest butterflies, seems to share in the increasing scarcity of butterflies in England. Barrett, writing in 1893, says, "It does not frequent the higher mountains, nor occur in the Orkneys and Shetlands, and in one or two places, as, for instance, at Huddersfield, appears, from some unexplained cause, to have died out; but with such exceptions there hardly seems to be a grassy field in the United Kingdom from which it is entirely absent."

It may be worth noting that only eleven butterflies are mentioned in the "Handbook Guide to Sheffield," published for the British Association in 1910, as found in the neighbourhood of Sheffield, and *E. janira* is mentioned among others, as "never common." Professor Meldola, writing in the "Entomologist" for April, 1911, speaks of the increasing rarity of the *Satyrinæ* (including *E. janira*) in many parts of the country, especially throughout the London district, and he is inclined to agree with other critics that it may be due to "the protection in modern times of small birds by Act of Parliament," and that in this case "the enemies of the *Satyridæ* must be sought for among those insectivorous birds which hunt among grasses for food, for the larvæ of this family are all grass-feeders. To this suggested cause may be added the fact that the *Satyridæ* are not migratory, and that losses by increased persecution are not made good by occasional immigration from the Continent, as in the case of the *Vanessidæ*"; or, we might add, in *Pieridæ* of the genera *Pieris* and *Colias*.

Turning to an earlier period, Stephens wrote in 1828: "This is probably the most common species of papilionaceous insect found in Britain. It abounds in every meadow and lane near the metropolis, during the month of July, and is abundant in the north of Britain." Another writer speaks of its extraordinary abundance in the "arid summer of 1826." But this was before the time of railways; besides which insect life in England was not only greatly affected by the terribly cold and wet summer of 1860, but some species of butterflies, etc., perhaps never fully recovered from the check which they received in that year.

There are several European species allied to *Epinephile janira*, and some of these have two eye-spots on the fore wings, one towards the tip, as in *E. janira*, and the other occupying a corresponding position towards the hinder angle.

Next to the Meadow Brown, the commonest (and also the smallest) of the British Satyrs, is the Small Heath Butterfly, (*Cœnonympha pamphilus*, Plate 6, fig. 3). It is common in most parts of the British Islands in grassy places, both on the plains and on hill-sides; but, like *E. janira*, it seems to be getting scarce both in the London district and in some parts of Yorkshire. It measures an inch and a quarter in expanse, and is tawny above, with narrow brown borders and a brown dot towards the tip of the fore wings.

Another meadow butterfly is the Marbled White (*Melanargia galathea*, Plate 5, fig. 1). In this country it seems, for some reason, to be most frequently met with on chalk or limestone, like so many insects which are local in England, though generally distributed on the Continent. In this country it is chiefly met with in the Southern and Midland Counties; but as it is gregarious, if you meet with one specimen you are likely to find as many as you want. The upper surface of the wings does not vary very much as a rule, though specimens are occasionally seen in which the brown or the white colour is so much extended as almost to exclude the other. There is an interrupted series of eye-spots on the under surface of the hind wings. This species cannot be confounded with any other British butterfly, but there are several allied species found in Southern Europe. By some of the older writers on British butterflies it was called the Half-Mourner, which reminds one of the little girl who heard her mother say that she was going into half-mourning, and asked her if her friends were half dead.

The Grayling (*Hipparchia semele*) is the largest of the

British Satyrs, measuring from one and three-quarters to two and three-quarters inches across the wings, which are brown, with a yellowish or tawny band (less complete on the fore wings of the male), towards the margins of the wings. There are two large black eye-spots on the fore wings, and a smaller one towards the hinder angle of the hind wings ; and the hind wings are mottled with brown and grey beneath. It is not uncommon in rocky places, especially on hill-sides and in open places in pine woods, and it is fond of resting on stones and tree-trunks, where the colour of the under surface renders it difficult of detection. There are many Continental butterflies allied to this, some of which are large and handsome insects, though their colours are not brilliant. They frequently rest on stones and tree-trunks in a similar manner ; and in the latter position it is difficult to capture a large and wary butterfly.

On moors, mosses, and heaths, in many places in the North of England, as well as in Scotland and in Ireland (at Killarney and elsewhere), we may meet with the Marsh Ringlet (*Cœnonympha typhon*). It resembles the Small Heath on the upper side, but is larger, measuring from one and a quarter to one and a half inch across the wings, which are tawny or tawny brown, with a band of more or less numerous and distinct eye-spots on the under surface of the wings, within which, on the hind wings, is an irregular, sometimes broken, white band. There are generally more or less distinct eye-spots on the upper surface of the wings too, or at least traces of them. The caterpillar feeds on various kinds of grass, sedge, and rush, especially Beaked Rush (*Rhynchospora alba*) and Cotton Grass. It is a very variable insect, and it is possible that when the transformations and habits of the various forms are known some of them may prove to be really distinct species. It is not known to occur in the South of England, unless an old record of its having been found in Ashdown Forest in Sussex is correct.

Many of the meadow-frequenting Satyrs may be found along lanes and hedgerows, especially where long grass and flowers grow up to the foot of the bushes ; but there are two common species which we have not yet considered which are specially fond of such localities. One of these is the Wall Brown (*Satyrus* or *Parage megæra*, Plate 5, fig. 8), which is common throughout the summer in most localities, flitting about and settling on flowers, and frequently on roads or sunny banks or walls, and from this habit it derives its name. But like

most of the British Satyrs, this species has for many years been disappearing from many places where it was once common. It is about the size of a Meadow Brown (nearly two inches in expanse), and is tawny above, with brown borders and zig-zag lines; in the male, the principal brown curved band is much broader on the fore wings. The hind wings are brown, and are marked by three or four submarginal eye-spots, surrounded with fulvous; within these is an irregular fulvous band. There is an eye-spot near the tip of the fore wings containing one white dot. The caterpillar is green with whitish lines. On the Continent we find an allied species (*Satyrus mæra*), in which the eye of the fore wings has two white pupils.

The Large Heath (*Epinephile tithonus*, Plate 6, fig. 2) is allied to the Meadow Brown, but is smaller, seldom measuring more than an inch and a half across the wings. The fore wings are fulvous, with the front and outer margin broadly brown and a black eye-spot containing two white dots towards the outer upper corner of the fulvous part; across the latter runs a broad brown band in the male. The hind wings are brown, with a broad fulvous band above, and an irregular pale band beneath, marked with rather inconspicuous eye-spots. It is a common insect in summer in many parts of the British Islands, and is fond of settling on flowers, especially bramble. The caterpillar is green with a reddish dorsal line.

We now come to the Satyrs which are more especially attached to woods, two of which are fairly common in many parts of our Islands, though the first is somewhat local. This is the Speckled Wood (*Satyrus ægeria*). It is somewhat like a Wall Brown, but is brown above, with numerous spots of a slightly yellowish white, with a rather inconspicuous eye-spot near the tip of the fore wings and a row of submarginal eyes on the hind wings, with white pupils, and surrounded by yellowish white rings. It is found in shady woods and lanes from spring to autumn. In the Mediterranean region this butterfly is usually fulvous instead of brown.

A large and handsome species is the Large White-banded Butterfly (*Hipparchia* or *Satyrus circe*, Plate 5, fig. 5), which measures about two and a half to three inches across the wings. Its dark brown velvety wings, with a broad band of white spots, are very distinctive. Near the apex of the fore wings is a white patch separated from the band, and having a brown eye-spot about its middle. It frequents dry meadows, and is very partial to old oak trees. The caterpillar is flesh-coloured,

with a dark brown dorsal band bordered with white longitudinal lines; on the sides are white, reddish, and dark longitudinal lines, and above the legs is an ochre-yellow stripe edged with white. The head is pale brown, with black streaks.

The small White-banded Butterfly (*H.* or *S. briseis*, Plate 5, fig. 6) is somewhat similar in markings, but is smaller and paler in colour. *H.* or *S. dryas* (Plate 5, fig. 7) is uniform dull brown, with two black spots on the fore wings centred with blue.

Another butterfly of this group is common in open woods in summer, and is the only one of the larger butterflies met with in the South of England which looks black on the wing. This is the Ringlet (*Hipparchia hyperanthus*), which is blackish brown above, with the under side paler, and marked with a variable number of black eye-spots in yellow rings, which are generally larger and more distinctly visible in the female, in which we usually find one or two visible on the upper side of the hind wings. In a rather uncommon variety the eyes have disappeared, leaving nothing visible but the white pupils as a row of dots.

There are numerous Continental species of the genus *Cœnonympha*, to which the Small Heath and the Marsh Heath belong. One of the commonest in woods on the Continent is the Bordered Ringlet (*Cœnonympha arcania*), which is very like our Marsh Heath, but has a broad brown outer border to the fore wings. It is said to have been met with several times in the South of England, but is not yet definitely recognised as a British butterfly.

Another dark-coloured butterfly of the woods is the Scotch Argus (*Erebia æthiops*, Plate 5, fig. 4), which belongs to a genus which chiefly inhabits mountain-slopes, and has very numerous representatives in the Alps and elsewhere in Europe, Asia, and America, but of which we have only two species in Britain. Some species, however, like the Scotch Argus, are found in woods on the plains, or on hill-sides. It is brown, with a submarginal row of eye-spots surrounded with tawny on the upper surface, and on the fore wings beneath; the hind wings beneath are obscurely banded with brown and grey. The present species is abundant in many localities in the North of England and in Scotland, and is even a common garden insect in some places. It is especially abundant in the Isle of Arran, where also another species, the Arran Brown (*Erebia ligea*), is said to have been taken with it. This butterfly, which is common in Norway and Switzerland, etc., is rather larger than

the Scotch Argus, and may be distinguished from it by having some clear white markings on the under surface of the hind wings. It is also an inhabitant of wooded hill-sides rather than mountainous districts, and as it is a gregarious species, like most of the Satyrs, it is far more probable that the record of its capture in the Isle of Arran was erroneous, than that it has become extinct in the island, as has been suggested.

Another woodland species, commoner than either the Scotch Argus or the Arran Brown on the Continent, is the Hill-side Ringlet (*Erebia medusa*, Plate 5, fig. 2), which may be distinguished from most of the other species of the genus by being clearly and distinctly spotted on the under surface of the wings as well as upon the upper.

The Mountain Ringlet (*Erebia cassiope*) is met with in swampy places high up on mountain sides in Scotland, Ireland, and the North of England. It is a smaller insect than its allies, measuring only an inch and a quarter across the wings, which are brown, with a more or less connected row of sub-marginal tawny spots on all the wings, containing black spots. It is considered to be a local form of *Erebia epiphron*, a butterfly common in Switzerland, where *E. cassiope* also occurs, but which differs from the latter in the black spots containing white pupils, which is not the case in *E. cassiope*. Among the numerous Alpine representatives of the genus *Erebia* we meet with several which exhibit a more or less distinct purple or coppery-green lustre. The butterfly which we have figured, *Erebia æme* (Plate 5, fig. 3), is found in the Alps, more especially in chalky districts. It is dark brown, with several small reddish brown spots, each containing a small black ring centred with white.

It has been suggested that some additions might be made to the British fauna in the mountain genus *Erebia*; but at the present day this hardly appears probable. It is remarkable how very few really mountain species appear to have reached the British Islands either from the Alps or from Norway.

THE SMALLER BUTTERFLIES OF OUR WOODS AND FIELDS

These may be grouped together in the present work. They fall under the two families *Lycænidæ* or Hairstreaks, Coppers, and Blues; and *Hesperiidæ*, or Skippers. The *Lycænidæ* are slender-bodied, delicate butterflies, with ample wings, and the caterpillars are onisciform (woodlouse-shaped), being short and

broad. The chrysalis is attached by the tail and a belt of silk round the body; or rests on the ground. The Skippers, on the other hand, have a rather stout body, with a large head, on each side of which stand stout antennæ, sometimes slightly hooked at the tip, and the fore wings are generally narrower than broad, and more or less pointed at the tips.

The Hairstreaks feed on trees and bushes, and are generally brown above, with slender white lines on the hind wings beneath; and the hind wings are usually adorned with a short slender tail. The Copper Butterflies are of a bright copper-red above, with brown or black spots; and the Blues are mostly blue in the males and brown in the females, on the upper surface of the wings.

The Brown Hairstreak (*Zephyrus betulæ*) is brown above, with a curved orange band in the female; the under surface is dull orange, with one white line on the fore wings and two on the hind wings. It is most frequently met with in the south of the British Islands, but is much less common with us than on the Continent. It flies along hedges and wood-sides in August, frequently settling, and its caterpillar, which is green with white stripes, feeds on birch and sloe.

The Purple Hairstreak (*Zephryus quercus*) is common among oak trees, on the leaves of which the reddish brown caterpillar feeds. The male is purplish above, and the female is brown, with a bright blue patch at the base of the fore wings; on the under surface it is bluish grey, with red submarginal spots, within which is a broad white line. When an oak-bush is shaken the butterflies are disturbed, and circle round for a few moments before settling again. The caterpillar is reddish grey with yellow markings.

There are two additional species of Hairstreak found in Britain, and others on the Continent, which are smaller than the two species just mentioned, measuring only about an inch and a quarter across the wings. They are brown above, with short tails on the hind wings; on the under surface they are marked with white lines, and with more or less distinct reddish or tawny submarginal spots and crescents beneath, and sometimes also above. They are both very local in England, and the White Letter Hairstreak (*Thecla w-album*) may be recognised by the very distinct white lines on the under surface of the wings. The caterpillar, which is light green with a brownish stripe along the back, feeds on elm, and the butterfly generally flies at a considerable elevation round elms and other trees.

It is somewhat capricious in its habits, and has been known to appear suddenly in vast numbers in a locality where it had not been previously observed, and then to disappear just as suddenly.

The Black Hairstreak (*Thecla pruni*, Plate 6, fig. 7), which is confined in England to a few woods in the Midland Counties, may be known by the white band of the under surface of the hind wings not forming a distinct W, and by the orange submarginal band beyond it being bordered with black spots. The caterpillar is green with elongated yellow spots on the back; it feeds on sloe, and the butterfly is found flying about bushes, or settling on the flowers of privet, etc., in June and July.

Several closely allied species are found on the Continent, one of which, *Thecla ilicis* (Plate 6, fig. 6), common in oak-woods, has the white lines of the under surface very broken and irregular. Most of these species prefer to settle on leaves rather than on flowers, but one Continental species, *Thecla spini* (Plate 6, fig. 5), distinguished from the others by having a blue patch near the anal angle of the hind wings beneath, is an exception, as it is in the habit of clustering on bramble and other flowers.

Among the Small Blue Butterflies there is one species which specially frequents woods and gardens, this is the Azure Blue (*Polyommatus argiolus*). The upper surface is of a light blue above, and the wings of the female are more or less broadly bordered with brown. The under surface of the wings is of a delicate bluish grey, with rows of small black spots. There is a spring brood, and another in the autumn; and it is one of the commonest and most widely distributed of the British species of *Polyommatus*, a name derived from the Greek, and having reference to the "many eyes" (eye-spots) with which the under surface of the wings is ornamented in most of the species. The caterpillar is greenish grey with a darker line along the back; it feeds on the flowers of holly and ivy. This species is widely distributed throughout Europe and Asia, and very closely allied species are found in North America and in other parts of the world. It is probably to this butterfly that Moore alludes in the well-known lines:—

"When, o'er the vale of Balbec winging
Slowly, she sees a child at play,
Among the rosy wild flow'rs singing,
As rosy and as wild as they;
Chasing, with eager hands and eyes,
The beautiful blue damsel-flies,
That flutter'd round the jasmine stems,
Like winged flow'rs or flying gems."

Moore quotes Sonnini, who probably refers to the beautiful dragonflies called Demoiselles by the French, the type of which is *Calopteryx virgo*, with purple body and partially purple wings, which is common in England and elsewhere, flying weakly over slowly-running water, and settling on the herbage of the banks. But it seems likely that Moore wrote this passage after seeing *Polyommatus argiolus* flying round jasmine in gardens ; and he seems to have specially admired blue butterflies, for in another passage he speaks of—

> The butterflies that bright and blue
> As in the mountains of Malay
> Around the sleeping infant flew.

It is perhaps not accidental, when we consider the literary and mythological associations of fairies and butterflies, that both these passages should be found in poems relating to Peris.

There is a little black and white butterfly called the Grizzled Skipper (*Hesperia malvæ*), which is common in many places in glades of woods and on heaths in early summer. Sometimes the white spots of the fore wings are massed together into a large blotch. Like most of the Skippers, the flight of the butterfly is very swift and jerky, near the ground, and not long sustained ; and it is not very unlike some of the smaller day-flying moths belonging to the *Geometræ*, especially those of the genus *Fidonia*, which are often found in its company. The caterpillar is generally green or brown, and feeds on bramble, raspberry, etc., in a covering of leaves ; and the chrysalis also is protected by a case of leaves, spun together with silk.

Another butterfly which is common in woods is the Large Skipper (*Pamphila sylvanus*). It is a brown and tawny butterfly, with a broad blackish bar of thick scales on the fore wings in the male, which is absent in the female. The under surface of the hind wings is greenish yellow, with indistinct pale yellowish spots. The butterfly is very fond of settling on flowers. The green caterpillar feeds on grass.

A much more local species in England is the Chequered Skipper (*Cyclopides* or *Pamphila palæmon*, Plate 7, fig. 1), which is found here and there in open places in woods in the Midland and Southern Counties of England, though, like the other Skippers, it is gregarious, and is generally common where it is found. It was formerly much more widely distributed, though it was always most abundant in the East Midlands ; and I think I

have heard that it was found commonly in a wood as near London as Barnet a few years ago. The butterfly flies about flowers, especially those of Bugle and Ground Ivy; and the green caterpillar feeds not on plantain, as has been erroneously stated, but on different kinds of grass, of which it forms a case where it lives through the winter.

Having dealt with the smaller butterflies which were more especially attached to the woods, we will now turn to those which prefer open country, such as meadows, heaths, and hill-sides.

Among these is one of the Hairstreaks, the Green Hairstreak (*Callophrys rubi*), the smallest and commonest of our British Hairstreaks, and the only one which is not adorned with a short tail on the hind wings. The upper surface is brown, without any red markings, and the under surface is bright green, with a more or less distinct and interrupted white line. The green caterpillar feeds on various plants, but seems to prefer Dyer's Weed (*Genista tinctoria*), while the butterfly is found in May, flying especially over bramble, on heaths and along woodsides, where it is very conspicuous, though the green under surface of the wings harmonises well with the beautiful green of the freshly-sprouting leaves.

Turning now to the Coppers, the Small Copper Butterfly (*Lycæna* or *Chrysophanus phlæas*, Plate 6, fig. 9) is a very conspicuous feature of our meadows and gardens. It is rather more than an inch in expanse, and may be known by the bright copper-coloured fore wings, with brownish black spots and border, and dark hind wings with a coppery border. The green pink-legged caterpillar feeds on various species of sorrel and dock.

The Smaller Copper is one of our commonest butterflies, but the Large Copper (*Lycæna dispar*), a similar but very much larger and more brightly-coloured insect, which was common in the fens of Cambridge and Huntingdonshire until about sixty years ago, suddenly disappeared when they were drained, and became, as is feared, totally extinct in England. This is the more to be regretted, as the nearest Continental form, *Lycæna rutilus*, is rather different, being smaller, and the hind wings are grey beneath rather than blue, as in the lost British species (*L. rutilus* is, however, believed to have also formerly inhabited England). The green white-dotted caterpillar fed on the Great Water Dock (*Rumex hydrolapathum*), a very conspicuous plant.

Two other species of Copper Butterflies are included as

British by several of the older writers, but are believed now to be extinct, if they ever really inhabited the country. They are the Purple-edged Copper (*Lycæna* or *Chrysophanus hippothoë*, otherwise called *chryseis*), and the Scarce Copper (*Lycæna* or *Chrysophanus virgaureæ*, Plate 6, fig. 8). On the Continent they frequent open flowery places on hill-sides or in woods. The caterpillars of these species are green, with pale lines, and they feed on different species of sorrel, and that of *L. virgaureæ* also on Golden Rod. The last species cannot be mistaken for any other, for it is marked with distinct white spots on the under surface of the hind wings. Some of the Continental "Coppers" are beautifully flushed with purple, and others have a slight tail on the hind wings.

The small butterflies of the genus *Polyommatus* are generally blue above in the males and brown, with a marginal row of orange spots, in the females; but in some species the females also are more or less blue, and in others the male is brown as well as the female. The shade of blue varies considerably in different species. On the under surface they are generally light brown or grey, with "many eyes," or black spots in white rings, and a marginal row of reddish or orange spots. In the middle of each wing stands a detached and often somewhat crescent-shaped spot, followed by a curved row of eye-spots. In some species there are one or two eyes nearer the base of the wing than the central spot, while in other species these are absent.

The commonest species is *Polyommatus alexis* or *Lycæna icarus* (Plate 6, fig. 11), appropriately called the Common Blue. It may be known from the other species by the wings being edged with a narrow black line, beyond which the fringes are white and unspotted. The male is lilac-blue; the female either brown or more or less blue, but always with reddish marginal spots which are absent in the male above. It is common in nearly all parts of the British Islands in meadows and grassy places throughout the summer, and the green caterpillar, which has a black head and a dark dorsal stripe, bordered with lighter, feeds on clover, trefoil, rest-harrow, and other low plants.

There is another species specially attached to meadows; but whereas *Polyommatus icarus* is the commonest of the British Blues, the Mazarine Blue (*Polyommatus semiargus* or *acis*) is at present by far the rarest; and no specimens have been taken in England for many years, yet it was once

not uncommon in certain localities, though always very local as a British species. The older writers speak of it as attached to chalky districts ; but this seems to be an error, as it is rather a meadow insect. When flying it resembles the Common Blue in appearance, but the male is more purplish, the female being brown. There are no red spots above or below in either sex, but the under surface is greyish brown, with central lunules, and a conspicuous row of eye-spots beyond. The caterpillar is yellowish green, and feeds on kidney-vetch (*Anthyllis vulneraria*) and allied plants.

Of the Blue Butterflies that frequent heaths and rough ground rather than meadows, the commonest, and also one of the most widely-distributed species of the British Blues, is the Silver-studded Blue (*Polyommatus argus*, or *ægon*). The male is purplish blue above, with a moderately broad brown border on the fore wings ; the female is brown, with a marginal row of orange spots. The species is distinguished from all other British species without tails by the presence of a row of silvery blue or green spots, placed on black triangles beyond the marginal orange spots on the hind wings beneath. The caterpillar is yellowish or green, and feeds on different kinds of vetch, and also in furze. The butterfly is fond of resting on stalks of grass or rush in dull weather or in the evening. This species has frequently been confused with an allied Continental butterfly, *Polyommatus* or *Lycæna argyrognomon* (Plate 6, fig. 10), to which the name *argus* has sometimes been applied, but which differs in the fore wings of the male only being bordered by a black line instead of having a moderately broad border. The caterpillar is green, with a dark head, a dark stripe on the back bordered with white, white traverse streaks on the sides, and a reddish brown line above the legs. It feeds on clover.

Two other remarkable Blues, the first of which is also adorned with metallic spots on the under surface of the hind wings, have been taken on rough ground on the South Coast, but merely as casual visitors. One of these is the Large Tailed Blue (*Lampides bæticus*), which is common in Southern Europe and Asia, and in Africa, and occasionally extends northwards along the West Coast of France to the Channel Islands and the South Coast of England. It measures about an inch and a quarter across the wings, which are purplish blue in the male, with two black spots near the hinder angle of the hind wings ; and brown in the female. Near the extremity of the hind wings is a rather long slender tail. The

under side is pale brown, with white streaks and lines, and the black spots near the hinder angle of the hind wings are ringed with orange, and marked with metallic green. The caterpillar is green or brown, and feeds in the pods of various leguminous plants, including the common pea. Single specimens of this butterfly have been taken at long intervals along the South Coast from Kent to Cornwall, but most frequently in Sussex. When the first specimen was taken, it was supposed by its captor to be a *Thecla*.

The Small Tailed Blue (*Polyommatus argiades*) is of still rarer occurrence in England than the last, though it is much more widely distributed in Central as well as Southern Europe, and throughout a great part of Asia, than the other species. The male is lilac-blue, bordered with brown; the female is brown, often with a few marginal spots on the hind wings, which have a short tail. The under surface is bluish grey or whitish, with numerous small black spots and dots, and a few marginal orange ones on the hind wings. The caterpillar, which is light green with a dark line along the back, feeds on trefoil, etc. The butterfly has been taken once or twice on heaths in Dorsetshire, etc., flying among other Blues, from which it is undistinguishable on the wing.

Another butterfly found on rough ground is the Large Blue (*Polyommatus* or *Lycæna arion*, Plate 6, fig. 14). It is the largest British species of *Polyommatus*, averaging an inch and a half across the wings; both sexes are blue, bordered, and on the fore wings more or less spotted, with black above. The caterpillar is pink, and feeds on wild thyme. The butterfly was always considered scarce and local in England, but it was formerly met with in many places throughout the Southern Counties, and here and there in the Midlands, the principal locality from which specimens used to be obtained for a long time being Barnwell Wold, in Northamptonshire. According to some accounts, it was deliberately exterminated in that locality by a dealer, while other writers attribute its disappearance to the disastrously wet and cold season of 1860, when many butterflies disappeared temporarily or permanently from localities where they used to be common. At present the butterfly still lingers in several localities in the Western Counties, but appears to be always very uncertain in appearance, fluctuating greatly in numbers in different years.

Several of our smaller butterflies, especially Blues, are generally found on a chalk or limestone soil, while they have a

much more general distribution in meadows and on hill-sides on the Continent. In England they are specially common on the South Downs, where they may all be taken together in grassy places on many hill-sides where thyme, trefoil, and other low plants grow between the bushes of furze and broom. The most brilliant of our British Blues is one of these: the Clifden Blue (*Polyommatus thetis*, otherwise known as *P. adonis* or *P. bellargus*). It resembles the Common Blue, except in the much greater brightness of the blue in the male, and in the white fringes of the wings being spotted with black at the ends of the nervures. The female is dark brown, sometimes slightly blue at the base, with red marginal spots, and the fringes black-spotted as in the male. The caterpillar is green, with a brown head, and feeds on *Hippocrepis comosa* (Horse-shoe Vetch) and other plants.

A closely-allied species is the Chalk-hill Blue (*Polyommatus corydon*), which is of a pale silvery blue in the male; and the female is of a somewhat lighter brown than in the Clifden Blue; the fringes are similarly spotted. The colour of the males of this species and the last are unmistakable even on the wing, and they cannot easily be mistaken for each other, or for any other British species. The Chalk-hill Blue is the type of the genus *Polyommatus*. Its yellowish green caterpillar feeds on vetch.

Among the allied Continental species not found in England is *Polyommatus* or *Lycæna damon* (Plate 6, fig. 12). The male is pale blue, with dark borders, and the female is brown; the fringes are white. The under surface is sparingly spotted, and differs from that of any British species in the hind wings being traversed by a continuous white streak, running from the base. The butterfly is found in many parts of Central and Southern Europe, and the green caterpillar feeds on Sainfoin (*Onobrychis sativa*).

The Brown Argus (*Polyommatus alexis*, otherwise known as *P. astrarche*, *P. agestis*, or *P. medon*) is brown, with red marginal spots in both sexes, and might easily be mistaken for a small dark female of the Common Blue; but there are no spots on the under side of the fore wings between the central spot and the base; the spots of the under side are black, ringed with white. The caterpillar which is green with a purplish stripe along the back, feeds on Rock Rose (*Helianthemum*) and Stork's Bill (*Erodium*). In the form found in the North of England, known as the Durham Argus (*Polyommatus*

salmacis), the marginal orange spots of the upper side, and the black spots of the under side are smaller and less numerous, and the black spot in the middle of the fore wings is often marked with white in the female. In Scotland we find a still more remarkable form of the species, called the Artaxerxes Butterfly (*Polyommatus artaxerxes*). In this the colour of the upper side is darker, with smaller red marginal spots, and there is a conspicuous white spot in the centre of the fore wing, while on the under surface the eye-spots are replaced by round white spots, giving it an appearance quite unlike any other British species. These forms are not known on the Continent; but even *P. artaxerxes* is no longer considered to rank as a distinct species. It was originally described by Fabricius in 1783, and is now known to be not uncommon in many places in Scotland, but for some time after it was first described it was supposed to be only found on Arthur's Seat at Edinburgh, and it is recorded that some of the Entomologists of that period undertook a journey to Edinburgh (a very formidable and expensive undertaking at that time) solely to obtain specimens, while others contented themselves with placing a drawing in a dark corner of their cabinets, hoping that visitors might mistake it for the real thing, and give them the credit for being the happy possessors of so great a rarity.

The last and smallest species of our British Blues is the Bedford Blue (*Polyommatus* or *Lycæna minimus* (or *P. alsus*), Plate 6, fig. 13). It is rather less than an inch in expanse; the male is bluish above, and the female is brown; and the under side is pale bluish grey, with no red spots, but with a row of small black eye-spots, and others nearer the base. The brown or pink caterpillar feeds on Kidney Vetch (*Anthyllis vulneraria*).

The British Blues are not very numerous, but many more species are found on the Continent, and the number found throughout the world runs into hundreds, if not thousands. In dealing with this mass of species it is convenient to divide them into many genera; but it is not worth while to do so when discussing our few British species. One curious point about the caterpillar of some species is that they are visited by ants, which appear to derive nourishment from their secretions.

One of the Skipper Butterflies, the Pearl Skipper (*Pamphila* or *Augiades comma*, Plate 7, fig. 3), is found commonly on the South Downs and other places, chiefly on a chalky soil (and especially in the South of England), in company with the Blue

Butterflies we have just been discussing. It differs from the Large Skipper already noticed, by the clear white spots on the under side of the hind wings. The caterpillar is green, or dark grey, with a double black line on the sides, and feeds on trefoil, &c. Like most of the Skippers, this species has a swift, jerky flight. On the Continent it is common in grassy places, and is not confined to the chalk.

Four more Skipper Butterflies are found in Britain on waste ground, but they are not specially attached to chalk and limestone, though they may be found on such a soil as well as elsewhere. The Dingy Skipper (*Thanaos tages*, Plate 7, fig. 6) is a dull brown butterfly with more or less distinct greyish bands, and whitish marginal dots. The under surface is paler. It is found in many parts of the British Islands in rough dry places, especially in lanes, where I have often seen it settling on the bare ground. The caterpillar is pale green, with a yellow stripe on the sides, dotted with black. It feeds on trefoil, etc.

Three other Skippers found in the British Islands frequent rough grassy places rather than meadows. They are all very similar, and expand rather more than an inch across the wings. The commonest is the Small Skipper (*Adopæa thaumas*, or *A. linea*, Plate 7, fig. 2). It is uniform fulvous, narrowly bordered with brown above, and with a black streak on the fore wings of the male. The antennæ are fulvous at the tip, and the under side of the wings is yellowish green, with a broad fulvous space on the inner margin. The caterpillar, which is green with whitish lines on the sides, feeds on soft grass; and the butterfly is common in most parts of the South of England, especially in damp grassy places.

The Scarce Small Skipper (*Adopæa lineola*) is very similar to the last species, from which it may be distinguished by the tip of the antennæ being partly black, and by the under surface of the wings being uniform greenish grey. The caterpillar is green, with yellow lines on the sides, and feeds on couch grass (*Triticum repens*), etc. This butterfly, which was only added to the British list twenty years ago, having previously been confounded (in England) with the common Small Skipper, is found in many localities in the Southern and Midland Counties, but is always very local in this country. It appears to be commonest in Essex, where it was first discovered, and some writers call it the Essex Skipper. Barrett writes, "It shows a singular partiality for the embankments which protect the

cultivated land from the inroad of the high tides which flood the salt marshes. Here it flits about, or sits on the coarse seaside grasses, or on blossoms of thistle, or *Lotus corniculatus*, indicating rather sluggish habits, yet flying swiftly when disturbed. Further inland it seems to frequent chalky hill-sides and marshes." On the Continent it is as common as the Small Skipper, and is often found in company with it.

The last British species we have to consider is the Lulworth Skipper (*Adopæa actæon*). It may be distinguished from the other species by having a pale fulvous stripe and a curved row of spots on the fore wings in the female, which is only slightly indicated in the male. The antennæ are black above and fulvous beneath. The caterpillar is pale green, with yellowish lines, and feeds on grass. The butterfly is extremely local in England, having first been found at Lulworth Cove, Dorset, and here and there on the coast of Dorset, Devon, and Cornwall, on rough ground near the sea, covered with weeds and coarse grass.

On the Continent it is not nearly so common and generally distributed as the two preceding species.

The Madder Skipper (*Erynnis* or *Carcharodes alceæ*, Plate 7, fig. 4) is reddish grey, with dark transverse bands; and *Hesperia carthami* (Plate 7, fig. 5) is greenish brown, with rows of well-defined white spots on all the wings. They both frequent dry sunny pastures, and are common throughout the greater part of Europe.

GENERAL NOTES ON MOTHS

Commercially, silk is the most important insect product. Butterfly caterpillars generally spin some threads of silk to fasten their chrysalides with; but those of many moths are enclosed in a case of tough silk called a cocoon, very like a small or moderate-sized bird's-egg in shape. By far the most important of these is the Mulberry Silkworm, which is reared in South Europe, and many other parts of the world, and gives employment to thousands of workers. The caterpillars and moths are white, and the cocoons vary from white to yellow. Eggs may be bought of many natural history dealers in England and the caterpillar can be fed on cabbage, if mulberry is not available; but the silk of British-reared silkworms is said to be too short to be of commercial value. The Mulberry Silkworm (*Bombyx mori*) appears to be nearer allied to our British Kentish

Glory (*Endromis versicolor*, Plate 12, fig. 5) than to any other British moth; but the silk of a great many other moths has been used in various parts of the world. Most of these belong to the family *Saturniidæ*, and are allied to our Emperor Moth (*Saturnia pavonia-minor*). Some of these are very large moths, with eye-like, or transparent, spots in the middle of their wings; but though the silk of many species is valuable locally, some of the insects are too difficult to rear, apart from their native countries, while the silk of others is of inferior quality; and consequently none of these can compete with the Mulberry Silkworm in commercial importance.

Caterpillars, as we have said, are chiefly plant-feeders, but while some species feed singly, a large number are gregarious, especially when young. Sometimes they swarm in such numbers as to strip whole plants and trees of their leaves; while other species live beneath the surface of the ground and destroy the roots of plants. Others, again, like the caterpillars of the Goat Moth (*Trypanus cossus*, Plate 28, fig. 9) eat galleries in the solid wood of trees. Apart from insect parasites, caterpillars suffer much from the attacks of birds, as we have pointed out already. These destroy vast quantities of them; but while some birds will eat caterpillars of any kind, some caterpillars and even some butterflies and moths are left entirely unmolested, being distasteful, if not actually poisonous.

This gives rise to a great number of scientific investigations of much interest and importance. A great number of insects are enabled to conceal themselves from their enemies by their colour. Leaf-feeding caterpillars are often green, and root-feeding caterpillars grey or brown. Butterflies with a dull under surface will alight on the ground, or on the bole of a tree, where they are almost invisible. On the other hand, certain harmless or edible insects resemble others which are not so, in so striking a degree that they are believed to share in their immunity. Thus the Hornet Clearwing (*Ægeria* or *Trochilium apiformis*, Plate 28, fig. 4), which rests on the trunks of poplars near the roots, in May or June, is so exactly like a hornet that you would be afraid to touch it, even if you knew what it was. In the Tropics, whole families of butterflies are more or less inedible, partly from toughness and partly from their disagreeable secretions; and there are many butterflies and moths belonging to edible families which resemble them so closely as to be undistinguishable from them except on careful examination.

This phenomenon is technically known as "mimicry," and although it is probable that some cases of supposed mimicry are rather due to similarity of surrounding conditions having produced similar results, yet there is good reason to believe that the current scientific explanation is in the main correct. We are always too apt to assume that if one explanation will explain a certain number of phenomena it ought to explain all, without considering that similar phenomena may often be produced by very different causes.

Another interesting subject relating to caterpillars is that of "warning colours." Edible caterpillars usually conceal themselves as much as possible; but there are some remarkably beautiful, and conspicuous caterpillars, such as those of the Spurge Hawk-moth (*Deilephila euphorbiæ*, Plate 9, fig. 1), which always feed openly on their food-plants, and flaunt their brilliant colours in the most conspicuous manner. These are poisonous caterpillars which have few enemies among birds, though they are by no means immune from the attacks of insect parasites such as ichneumons and the bristly two-winged flies belonging to the family *Tachinidæ*, which have habits like the Ichneumons.

Although some few female moths possess a conspicuous ovipositer, they cannot use it as a sting; but there are some caterpillars, such as those of the Brown-tail and Gold-tail Moths (*Euproctis chrysorrhœa*, Plate 11, fig. 5, and *Leucoma similis*), the hairs of which easily become detached, and sometimes cause considerable irritation to the skin. Still more is this the case with the Processionary Caterpillars (genus *Thaumatopœa*), which are found on forest or fruit trees or pine trees on the Continent, but which are not British; while some Indian and Australian caterpillars belonging to the family *Cochliopodidæ* have very formidable stinging powers indeed.

We will now consider the various groups of Moths more in detail.

THE BURNET MOTHS, TIGER MOTHS, &c.

In walking through the meadows on a sunny day, we frequently come across colonies of bright scarlet-spotted moths, booming along near the ground like humble-bees, though with a less rapid flight, or settling on the heads of thistles or scabious. They are moths with rather long and narrow purple fore wings, with red spots or streaks, and the hind wings

are red, bordered with purple. The fore wings expand from an inch to an inch and a half, and the bodies are rather hairy; the antennæ are stout, and strongly thickened towards the tip, which is sometimes more or less pointed. The caterpillars are green or yellowish, and feed on low plants, and the long narrow cocoons of tough yellow silk may often be found attached to grass stems.

There are a great number of species found on the Continent, but only a few in Britain, the commonest being the Six-spot Burnet (*Anthrocera* or *Zygæna filipendulæ*, Plate 27, fig. 13), which has six red spots on each fore wing, arranged in pairs. The caterpillar is yellow with rows of larger and smaller black spots. It feeds on clover, plantain, etc.

Some of the other species are common where they are to be found, but they are all more or less local. The Irish Burnet (*Anthrocera* or *Zygæna purpuralis*), found on the west coast of Ireland, and more locally on the west coast of Scotland, and here and there in Wales and Cornwall, is streaked, but all the other British species are marked with five more or less distinct spots on each wing, such as the following:

The Small Five-spot Burnet (*Anthrocera* or *Zygæna trifolii*, Plate 27, fig. 12), which has the pairs of spots usually more or less confluent and has a broad dark margin on the hind wings; this is common in damp woods.

The New Forest Burnet (*Anthrocera* or *Zygæna meliloti*, Plate 27, fig. 11), which is smaller in size, with the upper spot of the middle pair much smaller than the lower. It is found in the New Forest.

The Large Five-spot Burnet (*A.* or *Z. loniceræ*) is local in pastures. It is the palest coloured, and rather thinly scaled, with the spots usually distinct, and a narrow border to the hind wings.

The Mountain Burnet (*A.* or *Z. exulans*), though abundant on most of the mountains of Europe and in Scandinavia, etc., is confined, as a British species, to one locality in the mountains near Braemar. It has the upper spot at the base twice as long as the lower. The drab-coloured caterpillar feeds on *Azalea procumbens*.

The Scotch Burnet (*A.* or *Z. achilleæ*, Plate 27, fig. 10) has two elongated red spots at the base, two angular ones in the middle, and a large kidney-shaped one near the costa, externally. It usually occurs on chalk, and is found locally in Scotland.

We will now mention a few European species, which are not found in this country. *Anthrocera* or *Zygæna scabiosæ*

(Plate 29, fig. 9) has somewhat translucent dark blue or dark grecnish grey fore wings, with three elongated red spots.

The Variable Burnet (*Anthrocera* or *Zygæna ephialtes*, Plate 27, fig. 14) is so called on account of the large number of varieties which occur, many of which are known under separate names. It is common in many parts of Europe except the west. It is blue-black, with five or six round white spots on the fore wings, and one on the hind wing.

Anthrocera or *Zygæna carniolica* (Plate 27, fig. 15) is rather a southern species. It has shining blue-black fore wings, with six red spots ringed with white, and a broad red ring on the abdomen.

Allied to the Burnet Moths are the Green Foresters, which fly by day in meadows, but less heavily than the Burnets. The fore wings are green, and the hind wings and under-surface smoky grey. We have three species in Britain, all very similar, which differ chiefly in the shape of the antennæ, which are blunt or pointed; the caterpillars feed on sorrel and other low plants. The commonest species, the Green Forester (*Adscita* or *Ino statices*, Plate 27, fig. 16), is a meadow insect, and is recorded as having been found in Kensington Gardens less than a century ago. The other two species frequent dry hill-slopes.

Another family allied to the Burnets is that of the *Syntomidæ*, which has no representative in this country. These are moderately small moths, with slender bodies, with broadly triangular fore wings, and small hind wings, beyond which the abdomen projects for a long distance. The antennæ are long and setiform, and the palpi small. The caterpillars have sixteen legs and tubercles provided with tufts of hair.

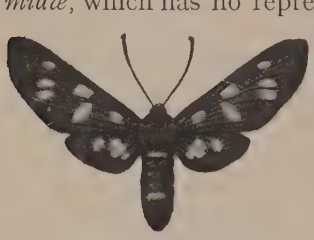

Fig. xi.—*Syntomis phegea.*

Syntomis phegea (Fig. xi.) occurs in light woods in Southern and some parts of Central Europe. Its wings are blue-black, with six small white translucent spots on the fore wings and two or three on the hind wings. The caterpillar is blackish with dense brownish grey hairs. It feeds on dandelion and plantain, &c.

Dysauxes ancilla (Plate 25, fig. 14) is a rather local species occurring in Central and Eastern Europe. It has ochre-brown wings, with white translucent spots. The caterpillar is ochre-brown with four yellow warts on each segment and a dark-brown head. It feeds on moss and lichens.

There is a common moth known as the Cinnabar Moth (*Hipocrita jacobææ*, Plate 27, fig. 1), which has much superficial resemblance to the Burnet Moths, though it is larger, with broader wings, and short and slender antennæ. The fore wings are light brown, with a red bar near the front edge, and red spots near the hinder border, and red hind wings. It is a sluggish gregarious insect, and its caterpillar is common on ragwort, especially in Ireland, where it is sometimes met with in extraordinary abundance. The caterpillar is black, with orange-coloured segments and black scattered hairs.

This species belongs to the family of the *Lithosiidæ*, or Footmen, the typical species of which have rather long and narrow wings, yellowish grey or buff, sometimes with a few black spots. Their caterpillars often feed on lichens, and the moths are very sluggish, and generally simulate death in the net.

The Crimson-speckled Footman (*Deiopeia pulchella*, Plate 27, fig. 2) is a great rarity in this country, being more a South European insect. It has cream-coloured fore wings with numerous small black spots, with somewhat larger red ones between them, more or less arranged in transverse rows. The hind wings are white, with irregular black margins. The caterpillar is grey, with a white line along the back, on each side of which are two black dots and a reddish transverse streak on each segment. It feeds on a variety of low plants.

The Large Footman (*Œonistis quadra*, Plate 27, fig. 6) expands about an inch and three-quarters. It has yellowish grey fore wings in the male, with the costa partially steel-blue. In the female they are ochre-yellow, with a black spot on the costa, and another above the inner margin. The caterpillar is greyish brown or blackish, with dark grey hairs, red warts and a broad yellow line along the back, interrupted by a black transverse spot on three of the segments. It feeds on lichens growing on oak, beech, pine, chestnut and fruit trees.

The Orange Footman (*Lithosia sororcula*, Plate 27, fig. 8) has uniform ochre-yellow fore wings, with the costa curved, and paler hind wings. It is local in this country, but common in woods on the Continent. The caterpillar is black with two yellow lines along the back, dotted with red and spotted with white. It feeds on lichens.

The Scarce Footman (*L. complana*, Plate 27, fig. 7) has leaden-grey fore wings, with the costa ochre-yellow. It is local, but is not uncommon in the South of England. The caterpillar is

dark grey with short black hairs and a row of orange-coloured spots on the sides. It feeds on lichens.

The Rosy Footman (*Miltochrista miniata*, Plate 27, fig. 4) has reddish ochreous fore wings, with the costa and hind margin brick-red. In front of the latter is a row of longitudinal black spots, and more internally a zig-zag black transverse line. The hind wings are pale yellow, tinged with rose-colour. It is common near woods in many parts of England as well as on the Continent. The caterpillar is greyish brown, with long dark grey hairs, and a brown or black head. It feeds from the autumn to May on lichens growing on oak, beach, and birch.

The Muslin Moth (*Nudaria mundana*, Plate 27, fig. 3) has pale yellow translucent fore wings, with two partially incomplete light brown zig-zag transverse lines and a small brown central dot. The hind wings are whitish and translucent. It is common on palings, tree-stumps, rocks and walls. The caterpillar is grey with blackish hairs, with two rows of yellow spots interrupted by a blackish transverse spot. It feeds on lichens growing on rocks and walls.

Two comparatively conspicuous moths of this family may be noticed. One is the Dew Moth (*Setina irrorella*), which expands an inch or over, and has yellowish wings, with three rows of black dots on the fore wings, and a few dots on the hind wings. It is found on rough ground near the sea, and in hilly districts, where the black, yellow-spotted caterpillar feeds on lichens among stones. There are several allied species found on the Continent, in the Alps, and elsewhere.

One of these, *Setina* or *Endrosa roscida* (Plate 27, fig. 5), has pale ochreous wings, with three transverse rows of black dots on the fore wings and a few black dots near the hind margin of the hind wings. It expands about an inch. The caterpillar is greyish brown, with blackish tufts of hair, and interrupted yellow lines on the back and sides. It feeds on lichens.

The last Lithosiid which I propose to mention is a larger and commoner insect, the Red-necked Footman (*Gnophria rubricollis*). It is black, with the extremity of the body yellow and the neck banded with red. It is more conspicuous for its peculiar colouring than for its beauty. The moth is found in woods, where its grey, black-lined caterpillar feeds on lichens growing on trunks of trees and palings.

The *Cymbidæ* are moderate-sized or small moths which fly at night. They have triangular wings, generally green

in colour, and the caterpillars, which have sixteen legs, feed on trees.

The Cream-bordered Green Pea (*Earias chlorana*, Plate 25, fig. 12) has broad triangular green fore wings, whitish along the costa; and white hind wings. It expands nearly an inch. It frequents marshes and is local in the South of England. The greenish, or yellowish grey, caterpillar feeds between rolled up leaves of willow.

The Green Silver Lines (*Hylophila prasinana*, Plate 25, fig. 13) has moderately broad fore wings, with oblique curved hind margins. They are green, with suffused whitish transverse lines. The fringes and inner margin are reddish purple in the male, and yellow in the female. The hind wings, which are short and narrow, and do not reach to the end of the abdomen, are yellowish in the male and white in the female. The caterpillar is yellowish green with yellow markings, and feeds on oak and beech.

The *Arctiidæ* or Tiger Moths include several of the commonest and most beautiful of our moths, some of which fly by day, or are easily disturbed. The caterpillars are very hairy, and as a rule are not very particular about their food, and will feed on a great variety of low plants.

Three species are common in gardens almost everywhere, one of which is the largest and most beautiful, the Common Tiger Moth (*Hypercompa* or *Arctia caja*, Plate 26, fig. 3). It measures two or three inches across the fore wings, which are of a warm brown, with interlacing white bands and stripes. The hind wings and abdomen are red, with large blue-black spots. This is a very variable insect, especially among specimens bred from the caterpillar in captivity; and sometimes almost black specimens are obtained. The caterpillar, which goes by the name of the "Woolly Bear," is black, with long tufts of white-tipped hair placed on white warts. The moth is common throughout the greater part of Europe, Asia, and North America.

We have several species of Tiger Moths, smaller and less common than the Common Tiger, and many more are known on the Continent. Most of them have dark fore wings, with interlacing white markings, and the hind wings red or yellow, with black spots. Some frequent woods (swampy woods in the case of the Scarlet Tiger, *Callimorpha dominula*), and others, such as the Cream-spot Tiger (*Hypercompa villica*), prefer waste ground. But though they are gregarious and may often be found in considerable numbers in special localities,

none of them are anything like so abundant or generally distributed as *H. caja*.

The Cream-spot Tiger (*Hypercompa* or *Arctia villica*, Plate 26, fig. 4) has black fore wings, with large white spots and yellow hind wings with black spots. The caterpillar is black with brown hairs arranged in tufts. It feeds on dock, plantain, and other low plants.

Among the more interesting Continental species of the family we may mention :—

Hypercompa or *Arctia hebe* (Plate 26, fig. 5). This has white fore wings banded and spotted with black, and red hind wings spotted with black. The caterpillar is black with dark grey hairs on the back and reddish hairs on the sides. It feeds on low plants.

The Spotted Tiger Moth (*Rhyparia purpurata*, Plate 26, fig. 1). This has yellow fore wings, with numerous small greyish brown spots, and purplish red hind wings with black spots. The caterpillar is black with rusty red hairs on the back and yellowish hairs on the sides. It feeds on sallow and low plants.

The Large Tiger Moth (*Pleretes* or *Pericallia matronula*, Plate 26, fig. 6), which expands over three inches, is the largest European representative of the family. It has dark olive-brown fore wings, with large yellow spots along the costa, and orange hind wings, with black spots. The caterpillar is brown with rusty brown hairs, and feeds on elm, hazel and other trees.

The Clouded Buff (*Diacrisia sannio*, Plate 26, fig. 2) is a more sober-coloured species. The male has yellowish fore wings, with a large reddish brown central spot, and cream-coloured hind wings, with a brownish grey central spot and submarginal band. The female has rusty yellow fore wings, with reddish nervures and a reddish central spot, whilst the hind wings have blackish markings. It is found in most parts of the British Islands in clearings in woods, and on heaths. The caterpillar is blackish with reddish hair and a yellow line along the back. It feeds on dandelion and plantain, etc.

Fig. xii.—Wood Tiger Moth (*Parasemia plantaginis*).

The Wood Tiger (*Parasemia plantaginis*, Fig. xii.) has black fore wings with yellow bands and spots. The hind wings are orange-coloured in the male, and more reddish in the female, with

black spots and marks. It is common in the British Islands and on the Continent of Europe. The caterpillar is black with reddish hairs, and black tufts in front and behind. It feeds on plantain, etc.

The two species which we shall now consider are most elegant and richly coloured. They are both local in the South of England, but the second species has been met with only in Devonshire.

The Scarlet Tiger (*Callimorpha dominula*, Plate 26, fig. 7) has greenish black fore wings, frequently verging into blue, with a number of larger and smaller cream-coloured spots, those near the base having an orange tinge. The hind wings are scarlet, with black spots and hind margins. The caterpillar is blue-black with an interrupted yellow stripe on the back and sides, and bluish grey tubercles with greyish brown hairs: the head is shining black. It feeds on nettle, strawberry, forget-me-not, bramble, and wild raspberry, and also on poplar and willow.

The Jersey Tiger (*C. quadripunctaria*, Plate 26, fig. 8) has greenish black fore wings, with a pale yellow pattern of bands and streaks, and dark red hind wings with black spots. The caterpillar is greyish brown or black with an orange-yellow line on the back, on each side of which are orange-coloured tubercles bordered with black; on the sides is a whitish or yellow interrupted line. It feeds on plantain, clover, broom, and other low plants, as well as on oak and beech.

The Ruby Tiger (*Phragmatobia fuliginosa*, Plate 25, fig. 16) is a common moth in open glades in woods, etc. It expands about an inch and a quarter and has rusty brown fore wings, with two small black spots near the middle of the costa; and red hind wings with two black dots in the middle and a row of black spots on the hind margin. The caterpillar is grey or brown with brown or reddish hairs, and a black or brown head. It feeds on forget-me-not, plantain, dock, lettuce, and other low plants.

Two common garden insects of this family are the White Ermine (*Spilosoma menthastri*, Plate 25, fig. 15) and the Buff Ermine (*S. lubricipeda*). They measure about an inch and a half across the wings, which are white, with numerous black dots in the former, and yellowish with fewer dots in the latter. The caterpillar of the White Ermine is dark brown and hairy; and that of the Buff Ermine is a light brown. They feed on nettle, mint, plantain, dock, etc.

SATIN MOTHS AND CASE MOTHS

The family of the *Liparidæ* or Satin Moths includes some of our commonest and most destructive hedgerow and fruit-tree pests, especially the Brown-tail and Gold-tail Moths, and the Vapourer Moths. The two former (*Euproctis chrysorrhœa*, Plate 11, fig. 5) and *Leucoma similis* measure an inch or an inch and a half across the wings, which are white, with a black spot (sometimes wanting) near the hinder angle of the fore wings. At the tip of the abdomen is a large fluffy tuft of brown or yellow down, which is used by the female for covering her eggs. The caterpillars are black, with reddish lines and white spots. They are gregarious, feeding under a common web when young, and then separating. The Gold-tail is abundant on hedges and fruit trees ; the Brown-tail is more local in England, though terribly destructive in North America, where it has been introduced. The Gold-tail caterpillars, and at dusk the moths, may be found in abundance on almost every hedge in summer. They are often united in their ravages by other pests, especially the Small Ermine Moths belonging to the genus *Hyponomeuta*, of which we shall speak later on.

Another moth, very similar to these, but larger, and less abundant, is the White Satin Moth (*Stilpnotia salicis*). It measures about two inches across the wings, which are pure white, unspotted ; and the legs are ringed with black. The caterpillar is black, with yellowish sides, and a row of white spots on the back. It feeds on poplar and willow, and the moth may often be found resting on the trunks of the trees.

But the most abundant species of the *Liparidæ*, and one of the very commonest of British moths, is the Vapourer (*Notolophus antiquus*). The male expands an inch, more or less, and is chestnut-brown, with a large white spot near the hinder angle of the fore wings ; the antennæ are short and strongly pectinated. But the female has mere rudiments of wings, and is quite incapable of flight, though the male may be seen on any summer day flying everywhere near trees, even in many of the streets of London ; for it abounds in the parks, and there is scarcely a tree or bush on which the caterpillar will not feed. The latter is blackish, with reddish spots, and several long black and shorter yellow tufts of hair on the back.

There is another species, also found in the British Islands, but which is more local in the South of England. This is known as the Scarce Vapourer Moth (*Notolophus* or *Orgyia gonostigmus* Plate II, fig. 3). The male has reddish brown fore wings, with a row of white spots on the costa and hind margins. The female has very rudimentary wings. The caterpillar is black, with long yellowish brown tufts of hair and a red band round the neck. It feeds on various deciduous trees.

The Tussock Moths are grey moths, with darker markings, which are common in most parts of the British Islands. The females have fully developed wings. The Pale Tussock (*Dasychira pudibunda*, Plate II, fig. 4) has pale grey fore wings dusted with dark grey, with dark transverse bands and darkly spotted fringes. The caterpillar, which is adorned with tufts of yellow hairs, and has a red tuft near the extremity, is sometimes destructive to forest trees. It also feeds on hops.

Another day-flying moth, often terribly destructive on the Continent and in North America, where, like the Brown-tail Moth and the Small White Butterfly, it has been introduced, is the Gipsy Moth (*Ocneria* or *Lymantria dispar*, Plate II, fig. 6). It derives its name from the striking difference in the sexes. The male measures an inch and a half across the brown fore wings; the body is only moderately stout, and the antennæ are broadly pectinated. The female is about an inch longer, with a very stout body, and very slightly pectinated antennæ, and the colour is greyish white. The male may be seen everywhere flying about bushes and hedges, but the female is generally found at rest on tree-trunks or palings. The caterpillar is brown with blue and red tubercles, and feeds on all sorts of forest and fruit trees. Formerly it inhabited the fens of the Eastern Counties, but otherwise was always rare in England; and is now happily extinct as a British species, so far as is known.

An allied moth, the Black Arches (*Lymantria monacha*, Plate II, fig. 7), is also a great pest in the pine-forests of Europe, but is not sufficiently abundant to be very destructive in Britain, though it is by no means rare. The sexes are nearly similar, and the moth expands an inch and a half or two inches across the wings, which are yellowish white, with black spots and zig-zag lines. The abdomen is red, spotted with black, and there is a distinct yellow ovipositer in the female. The caterpillar is grey, with black spots and markings, and feeds on a variety of trees.

The Case-moths (*Psychidæ*) are small moths measuring

half an inch or an inch across the broad, rounded wings. They are generally of a uniform dull grey or blackish colour, and fly low down among the grass, something like Burnet Moths, but lower. The females are apterous (wingless), and in some cases are without even legs or antennæ, and never quit the cases in which the caterpillars and chrysalides live. The species are often very similar, and very difficult to distinguish.

We will mention three of these curious insects as examples of the group :—

The Black Case-moth (*Acanthopsyche opacella*, Plate 28, fig. 1) has all the wings uniform translucent greyish black in the male. The female is worm-like, with a small dark plate on the back of the first abdominal segment. The caterpillar is dingy yellow, with dark yellow spots on the dark brown back. It lives on heath, and its case, which is covered with portions of stem and particles of earth, is about an inch long.

Psyche viciella (Plate 28, fig. 2) has brownish grey wings, thinly scaled, especially towards the margins, and the body is yellowish. The female is very stout, orange-coloured, with a dark plate on the back. It is a Central and Southern European species. The caterpillar is dull olive-green, with dark brown spots on the back, marked with yellow, and has a stout case covered with particles of low plants.

Apterona crenulella (Plate 28, fig. 3) has delicate uniform brownish grey translucent wings in the male ; whilst the female is delicate and worm-like. The caterpillar is greyish green, and lives on low plants. The case, which is made of fine particles of sand, is peculiar in having two spiral turns, like a snail-shell.

PUSS MOTHS, PROMINENTS, &c.

The moths belonging to the family *Notodontidæ* differ much from those we have just been considering in their caterpillars, which are generally almost naked, with humps on the body, and never clothed with shaggy hair, as in the Tiger Moths, etc. They are frequently peculiar in form, and are often humpy ; and the anal claspers are sometimes replaced by linear appendages. Many of the species have a tooth-like projection of scales on the inner margin of the fore wings, which has given rise to the name of " Prominents." The species average about two inches in expanse, and the wings are not very brightly coloured.

One of the largest species is the Puss Moth (*Cerura* or *Dicranura vinula* (Plate 10, fig. 2), which sometimes expands as

much as three inches. It is a greyish white, with zig-zag transverse blackish lines on the fore wings ; the antennæ are strongly pectinated in the male, but only slightly in the female. The moth may be found resting on the trunks of poplars and willows, on the leaves of which the caterpillar feeds. The caterpillar is a very curious creature. It is green, with a broad blue-black band on the back, edged with white or yellow ; this is widened like a saddle about the middle of the body, and becomes narrow behind ; the front of the body is very stout, and the back is humped in front of the band, and the body tapers behind. The anal claspers are replaced by two long hollow tails enclosing red whip-like filaments, which can be extruded to frighten or drive away enemies, like the retractile forks on the neck of the caterpillars of the Swallow-tail Butterflies. The Puss Moth caterpillar makes a very hard cocoon of fragments of wood.

There are several other species of *Cerura* found in the British Islands. They are very like the Puss Moth, but are smaller, and much less common, and are generally known as " Kittens." As an example, we have figured the Barred Kitten (*C. hermelina* or *bifida*, Plate 10, fig. 1), which is pale grey, with a dark grey patch near the tip of the fore wings and a broad transverse band with straight or slightly curved edges. The caterpillar is green, with a large brown head bordered with red ; there is a purple band on the back, expanded in the middle and edged with white. It feeds on willow and poplar.

The Lobster Moth (*Stauropus fagi*, Plate 10, fig. 3) is nearly as large as the Puss, and is brown, more or less varied with yellowish grey. It is not considered a very common moth in the British Islands. It derives its name from the extraordinary shape of the caterpillar, which has been compared to an ant when young, and to a spider when larger. It feeds on beech and other forest trees. It is brown, with a double row of pointed humps on the back ; the second and third pairs of legs are very long, and the anal claspers are replaced by two short tails, which, however, are not hollow like those of the Puss Moth. Some caterpillars have a habit of devouring their companions, and although the Lobster is not a regular cannibal, it is said that the caterpillars will sometimes nibble the long legs of their companions. They feed on beech and other trees, including fruit trees.

An anecdote is told of an Entomologist who had climbed up a lamp-post and slid down into the arms of a policeman, who asked what he was doing. " Catching a Lobster," said

the Entomologist, in high glee ; but although this term is not usually applied to the preservers of the peace, it was accepted as a personal affront, and did not tend to smooth matters over.

A rather similar, but smaller moth is the Marbled Brown (*Drymonia trimacula*, Plate 10, fig. 4). This has greyish brown fore wings, with a broad pale transverse band, and pale grey hind wings. The caterpillar is shining green or yellowish, with two slender cream-coloured lines along the back, and similar, but interrupted lines on the sides, having a sulphur yellow line containing red dots below them. It feeds on birch and oak scrub.

The Pebble Prominent (*Notodonta ziczac*, Plate 10, fig. 5) is a common British moth. It has yellowish brown fore wings dusted with silvery grey on the middle of the costa, and has an oblique rusty brown lunule near the centre of the costa and a streak near the apex. The hind wings are whitish in the male, darker in the female. The caterpillar is violet or rose-coloured, with a hump on one of the segments in the middle and another at the end of the body, and orange-coloured spots at both extremities. It feeds on poplar and willow.

Fig. xiii.—*Ochrostigma melagona.*

Another species, which is found in the southern parts of Central Europe, but is somewhat local, is *Ochrostigma melagona* (Fig. xiii.). This has violet-grey fore wings, with two paler bands, the inner being acutely dentated. The apex is spotted with black. The caterpillar is pale green with cream-coloured lines. It feeds on beech. The pupa stage sometimes continues for several years.

There are two common moths of this family which may often be seen resting on tree-trunks, where, however, they are very likely to escape observation. But the caterpillars are very often abundant and conspicuous. One of these is the Buff-tip Moth (*Phalera bucephala*, Plate 10, fig. 9), which measures two inches and a half in expanse. The fore wings are purplish brown, varied with grey, and the extremity and the hind wings are of a pale yellow or buff colour. When the moth is at rest, it has a deceptive resemblance to a broken piece of stick. The eggs are laid in clusters on leaves, and the gregarious caterpillars are somewhat pilose, and are yellow, with longitudinal black lines. They feed on many kinds of forest trees, and are often very destructive.

Another common insect is the Figure of 8 Moth (*Heteromorpha* or *Diloba cæruleocephala*, Plate 15, fig. 10). It is smaller than the Buff-tip, measuring only an inch and a half across the wings. It has light brown fore wings and paler hind wings, and on the fore wings are two pale marks, one or both of which usually resemble a figure of 8. The caterpillar is yellowish green, with black tubercles and yellow stripes; the head is blue, with black spots. It feeds on the leaves of hawthorn, sloe, and various fruit trees, and is occasionally abundant enough to cause some damage.

The Chocolate Tips (genus *Melalopha*), of which there are several closely allied species, some of which scarcely measure an inch in expanse, are the smallest moths of this family. They are purplish brown, with a large reddish blotch towards the tip of each fore wing. The most widely distributed is the Small Chocolate Tip (*Melalopha* or *Pygæra pigra*, Plate 11, fig. 1). It has brownish grey fore wings, with pale transverse lines and reddish brown apices. The hind wings are dark grey. The caterpillar is dark grey above with two rows of small yellow tubercles on the back, and is ochreous beneath. It feeds on willow and aspen.

There are several genera which are called Prominents owing to their possessing a projecting tuft of scales on the hinder border of the fore wings. They are of moderate size, and generally of dark colours; but the White Prominent (*Hierophanta* or *Leucodonta bicoloria*, Plate 10, fig. 6) is an exception, being of a pure white, with a few orange markings bordered with black spots on the fore wings. The caterpillar is green, with a yellow line on the sides and feeds on birch. This is one of the rarest British species, only single specimens having been taken at long intervals in the West of England and Ireland.

The Coxcomb Prominent (*Lophopteryx camelina*, Plate 10, fig. 7) is a common British moth. It has rusty brown fore wings, with dentated edges, and dark zig-zag transverse lines; and brownish grey hind wings. The caterpillar is green or reddish, with two hairy points near the extremity, tipped with red. It feeds on birch and lime.

The Plumed Prominent (*Ptilophora plumigera*, Plate 10, fig. 8) is more local, being only met with in the South of England. Its fore wings are pale rust-colour, varied with brownish, with an ill-defined transverse band. The hind wings are yellowish grey. The caterpillar is yellowish green with a dark

green line along the back, edged with white, and with whitish lines along the sides. It feeds on beech and maple.

Several genera of *Notodontidæ* are very gregarious in the caterpillar state. The caterpillars of the African genus *Anaphe* are so, and form large nests, in which a hundred or more assume the chrysalis state in company. On the Continent of Europe the Processionary Caterpillars of the genus *Thaumatopœa*, which live on oak and pine gregariously, march forth to feed in serried armies. They are also highly protected insects, being covered with barbed hairs which are terribly irritating, and make it dangerous to approach their feeding grounds.

The Processionary Moth (*Thaumatopœa processionea*, Plate II, fig. 2), the commonest of the genus, has broadly triangular, shining yellowish grey fore wings, with blackish grey transverse lines, and an indistinct central spot. The hind wings are yellowish white, with a dark suffused transverse band. The female is paler, with thinner scales. It frequents oak woods, flying amongst the topmost branches. The caterpillar is dark bluish grey, whitish on the sides, with a row of reddish brown tubercles on the back, provided with long hairs. It feeds on oak, but some of the other species attack fir and pine trees.

THE HAWK-MOTHS

The Hawk-moths are among the largest and most interesting of the Moths, and cannot easily be mistaken for any others. Their bodies are very stout, and taper behind, their eyes are large, the antennæ rather thick, especially in the middle, and often hooked at the tip, and the wings long, narrow, and pointed. Most of the species have a very long proboscis, and hover over flowers without resting, probing the flowers with their proboscis, and sucking the honey. Those which have a shorter proboscis fly much more heavily. Some species are migratory, such as the beautiful green Oleander Hawk-moth (*Daphnis nerii*), a moth more than four inches in expanse, which is common in Africa and the South of Europe and Asia, but is only a rare and accidental visitor to England. By the early authors the Hawk-moths were generally called *Crepuscularia*, because many of the species fly at twilight. The caterpillars are thick, fleshy creatures, generally brightly coloured, and with an appendage on the back called a "horn" before the extremity of the body. The chrysalis is almost always

reddish brown, and is generally placed in an earthen cell under the surface of the ground.

The largest European species is known as the Death's Head Hawk-moth (*Acherontia atropos*, Plate 7, fig. 7). It is not only the largest, but in many respects one of the most interesting of the Hawk-moths. Although it is common in most parts of the Old World, the moth is rarely seen, for, unlike most Hawk-moths, it flies very late at night, and has great powers of flight, sometimes coming on board ship miles away from land. The caterpillar is generally yellow, striped with violet; it often varies in colour, however, and some specimens are much darker, and are occasionally nearly black. Its size and the rather unusual shape of the horn will serve to distinguish it from any other species. It feeds on different species of Nightshade, and various other herbs and shrubs, but in England most commonly on potato leaves. The chrysalis is generally found buried several inches under the surface of the ground.

The moth averages about five inches in expanse, and is remarkable for the curious pattern on the back of the thorax, from which it derives its name, and for its short strong proboscis. It has been said that this is the only Lepidopterous insect gifted with a voice, and though this is an exaggeration, it is the only British insect capable of producing a sufficiently loud sound to attract the attention of casual observers. Not only the moth, but even the pupa when nearly ready for the moth to emerge will squeak like a mouse; while the caterpillar also produces a crackling sound with its mandibles. The cause of the sound produced by the moth has been much debated; but I doubt if Entomologists are yet agreed upon the subject. Those interested in the subject may consult the long summary in Tutt's "British Lepidoptera," vol. iv.

By some authors the Death's Head Hawk-moth is called the Bee Tiger Moth, for it is extremely fond of honey, and will penetrate into a hive whenever the opening is sufficiently large to admit it, and cause great damage. It is believed that the squeak of the moth has a similar hypnotic effect on the bees as the voice of the Queen Bee. If the moth should die in the hive, the bees will embalm it in propolis, in the same way as they would treat a snail, or any animal entering the hive which was too large for them to be able to eject it.

During the Colorado Beetle scare some years ago, almost any animal found in or near a potato patch was liable to be

mistaken for the dreaded pest; and among them sometimes even the caterpillar of the Death's Head Hawk-moth.

Like certain other butterflies and moths, the Death's Head Moth sometimes emits a peculiar scent, like that of flowers.

Two other Hawk-moths, not very much smaller than the Death's Head, and easier of observation, are frequent visitors to our gardens. The commonest is the Privet Hawk-moth (*Spinx ligustri*, Plate 8, fig. 2). The moth may sometimes be found resting on tree-trunks or palings in the day-time, and hovers over flowers in the evening. The caterpillar may be found on a variety of trees and shrubs, as well as privet. The peculiar attitude assumed by this caterpillar when at rest suggested the name Sphinx, which therefore makes this insect typical of the whole family of Hawk-moths to which it belongs.

The Convolvulus Hawk-moth (*Sphinx* or *Protoparce convolvuli*, Plate 8, fig. 3) is a greyer insect, without the pink colour visible in the Privet Hawk, except on the sides of the abdomen; the hind wings being banded with blackish brown and grey. It is widely distributed in the Old World, and is very common in England in some years, flying over flowers at dusk in gardens, when it is very easy to capture with a net; while in other years it is much scarcer, or perhaps hardly noticed at all. The proboscis which it inserts into flowers to suck the honey is longer than in any other British moth, measuring four and a half inches in length, and the chrysalis is provided with a separate sheath to contain it. The caterpillar is brown or green, with oblique yellowish stripes bordered with blackish, and feeds on different species of bindweed. The caterpillar is not often found in England, and there is little doubt that, as in the case of many other butterflies and moths, most of the Convolvulus Hawk-moths seen in Britain are immigrants from abroad, and not British-reared specimens.

It is curious how Entomology, like other studies, has gone through alternating phases of opinion. At one time blind faith held the field, and almost every insect reported to have been captured in England or found in a collection of British insects was introduced into the British list without question; while almost every insect that was known to come from abroad was supposed to be Indian. Thus a large proportion of the species figured in Donovan's "Insects of India" (1800) are not Indian at all, but South American or African. Again, in Humphreys and Westwood's "British Butterflies" (1841)

many Continental and even North American species are figured owing to reports of their having been found in England, or to varieties of British species being mistaken for distinct Continental ones. Then succeeded a time of scepticism on the one hand, and blind submission to authority on the other (about the fifties). At that time many insects which had been generally accepted as British were struck off the list merely because specimens had not been taken for some years; while many British Entomologists accepted as infallible the decision of Doubleday and Guenée about the correct identification of a species, or whether it could possibly be accepted as British; while it was considered disgraceful for a British Entomologist to have a Continental insect in his collection or to know anything about them, for fear they might be supposed to be British.

Among the species thus unceremoniously excluded from our lists (though it was still retained by Stainton in 1856) was the Pine Hawk-moth (*Sphinx pinastri*, Plate 8, fig. 4), which, though abundant and destructive in the great pine forests of Europe, is a very rare insect in most parts of the British Islands. It is now known, however, to breed regularly in various parts of Suffolk, and specimens are occasionally met with in other parts of England and Scotland. The caterpillar is green, with a reddish brown line on the back and yellow longitudinal lines on the sides; and a brown form is occasionally met with. It feeds on fir and pine. The moth is sometimes taken flying over honeysuckle and other flowers in the evening, but is very fond of resting on tree-trunks in the daytime; and most specimens not obtained by rearing from the caterpillar have been taken in this manner.

The Hawk-moths of the genus *Chœrocampa* (Hog Caterpillar), or Elephant Hawk-moths, are remarkable for the curious structure of the caterpillars, the front segments of which are tapering and somewhat retractile, giving them a fanciful resemblance to a pig's snout, or an elephant's trunk. We have four species in Britain, two of which are very rare, and can only be considered casual visitors. One is the large green Oleander Hawk-moth, already referred to, and the other is the Sharp-winged Hawk-moth (*Chœrocampa celerio*), which may be known from any other British species by its very long and pointed light brown fore wings, with a curved silvery stripe running from the lower part of the base to the tip; and its brown and pink hind wings. The caterpillar feeds on vine,

fuchsia, or Virginian creeper, and is green or brown, with two round black spots on each side of the fifth and sixth segments, ringed with yellow and centred with white or yellow dots ; the horn is brown. The moth is very fond of light, and is more frequently attracted by light than by flowers. It is very widely distributed throughout the Old World.

In addition to these, two other species of *Chœrocampa* are found not uncommonly in the British Islands, which may be captured at dusk hovering over honeysuckle and other flowers, or may be reared from the caterpillars. These are called the Large and Small Elephant Hawk-moths respectively (*Chœrocampa elpenor*, Plate 9, fig. 2, and *C.* or *Metopsilus porcellus*, Plate 9, fig. 3). The latter is smaller and more varied, with yellow. The caterpillar of the Large Elephant feeds on vine, fuchsia, etc., but especially on willow-herb, and the moth is therefore often met with in swampy places, where, Barrett says, it is particularly fond of the flowers of the yellow flag. It is brown or green, with two round black spots on each side, enclosing white or yellow lunules centred with black ; the horn is black, tipped with white. The caterpillar of the Small Elephant is brown or green, with the usual lateral ocellated spots ; it feeds on bedstraw.

There is another genus containing three very beautiful moths allied to the Elephant Hawk-moths, which you may perhaps be fortunate enough to meet with, flying over flowers in the garden or elsewhere in the evening ; or if you care to get up sufficiently early, at morning twilight. This is *Deilephila*, and all the species are rare in Britain, though the one which is least rare and probably the only one which breeds permanently in these islands is the Madder Hawk-moth (*Deilephila galii*, Plate 8, fig. 5). It will be noticed that the wings are only moderately long and pointed, and that the colour and pattern is quite different from that of *Chœrocampa ;* moreover, the segments of the caterpillars of *Deilephila* are not retractile. The caterpillar varies from olive-green to almost black, with a red horn and a row of yellow spots in black rings on the sides. It feeds on madder, willow-herb, fuchsia, and other plants, but is most frequently found feeding on bedstraw on coast sand-hills.

The other two species are apparently only casual visitors to England, and though caterpillars are sometimes met with, they do not seem to perpetuate the species, but die off in one or two seasons at most. Yet the Spurge Hawk-moth (*Deilephila euphorbiæ*, Plate 9, fig. 1) is abundant and gregarious in most parts of the Continent. It may be distinguished from

the Madder Hawk by the fore wings being flushed with pink, and the pale stripe much broader and more suffused. The caterpillar is black, with yellow spots and dots on the sides, and a red stripe on the back and a red horn. It seems to be specially abundant on the Cypress Spurge and Sea Spurge (*Euphorbia cyparissias* and *E. paralias*), growing in sandy soil, both near the sea and inland, and though liable to the attacks of lizards, predaceous beetles, and other insectivorous animals, including Hymenopterous parasites, and bristly two-winged flies of the family *Tachinidæ*, its poisonous juices make it distasteful to most birds, though it is said that sea-gulls will eat it.

The third British species of *Deilephila* is the Striped Hawk-moth (*D. livornica*). It differs from the Madder Hawk-moth in the pale stripe of the fore wings being narrower and straighter, and in the nervures of the fore wings being silvery white; there are also four longitudinal white stripes on the thorax. The caterpillar is green, with yellow and pink spots and dots, and a black or pink head, dorsal stripe, and horn; but seems to be very variable. It feeds on vine, fuchsia, and a variety of other plants. The moth is a casual visitor in the British Islands, from the Mediterranean region, where it is sometimes taken flying over flowers at dusk; or (rarely) in the daytime. Caterpillars have sometimes been found in England, but it is very doubtful whether the insect permanently breeds here.

We now come to the last genus of true *Sphingidæ*, *Smerinthus*, of which we have three species in Britain, representing three very distinct groups of the genus, and all comparatively common. They may be known from the other Hawk-moths by their short proboscis and more or less indented fore wings. Their flight is rather heavy, and they may be found flying about the trees on which their caterpillars feed at dusk, or resting on tree-trunks, etc., in the daytime; they do not visit flowers much. The caterpillars of all the species are green, and the surface of the body is rough. The Eyed Hawk-moth (*Smerinthus ocellatus*, Plate 7, fig. 9), distinguished by the eye-spot on the hind wings, has a caterpillar striped with white, with a blue horn. It feeds on various fruit and forest trees, especially on apple. The Poplar Hawk-moth (*Smerinthus populi*, Plate 7, fig. 8) is variable in ground-colour, but has a large reddish brown spot on the hind wings. The caterpillar is striped with white or yellow, and the horn is blue at the base and yellow at the tip, it feeds on poplar and willow. The Lime Hawk-moth (*Smerinthus* or *Dilina tiliæ*, Plate 8, fig. 1) varies

considerably, but is generally reddish brown, with a green band, often interrupted on the fore wings. The caterpillar feeds on lime ; the oblique stripes are reddish above and yellow below, and the horn is blue or green, with a reddish or blue-black callosity behind.

The Humming-bird Hawk-moths and the Bee Hawk-moths belong to a somewhat different group to the true Hawk-moth, from which they are distinguished by their smaller size, the expansible fan-like tuft of hair at the extremity of the body, and their habit of flying by day. The Humming-bird Hawk-moth (*Macroglossa stellatarum*, Plate 9, fig. 5) is very common in the British Islands in many seasons, flying over flowers in gardens and elsewhere, both throughout the day and at dusk, in the manner of a humming-bird, and sucking up the honey. Its flight is exceedingly rapid, and if disturbed it darts away with the speed of an arrow. It is, however, in the habit of flying along walls and banks, and occasionally resting in places where its dull colour protects it from observation. It often wanders out to sea and flies on board passing ships ; or if there are flowers on deck it will sometimes accompany a ship out to sea ; but in such a case it is liable to wander away again during the voyage, and be lost. The caterpillar, which feeds on bedstraw, is green, with pale longitudinal stripes, and a short blue horn, tipped with yellow.

M. croatica (Plate 9, fig. 6) is a more brightly-coloured species, inhabiting the south-eastern Alps. The caterpillar varies from cream-colour to dark green with fine white dots and a broad white stripe on the sides. It feeds on scabious.

The Green Humming-bird Hawk-moth (*Pterogon proserpina*, Plate 9, fig. 4), which is found in Southern and portions of Central Europe, has greyish green fore wings, with olive-green bands, and ochre-yellow hind wings broadly bordered with blackish. The wings are elegantly dentated. The caterpillar is green or greyish brown with darker lines and streaks, and an ochreous spot at the extremity. It feeds on willow herb (*Epilobium*).

The Bee Hawk-moths, of which there are two British species, are of about the same size, but the wings are transparent except on the borders, the centre being only clothed with loose scales on first emerging from the chrysalis, and these are lost almost immediately. They are found flying over flowers in open spaces in woods, or over hedgerow flowers, in spring. They have purplish brown borders to the transparent wings,

and the caterpillar of the Narrow-bordered Bee Hawk-moth (*Hemaris tityus* or *scabiosæ*, Plate 9, fig. 7) feeds on scabious, and is green, with a reddish horn.

The other British species, the Broad-bordered Bee Hawk-moth (*Hemaris fuciformis*), has broader and more reddish brown borders to the fore wings and a transverse streak on the fore wings before the middle. The caterpillar, which feeds on honeysuckle, is green, with yellowish lines on the back and sides and a reddish horn.

Allied to the Bee Hawk-moths is a pretty little moth (*Thyris fenestrella*, Plate 13, fig. 6), which is found in Southern Europe and the more southern parts of Central Europe. It is velvety dark brown, with white and brown fringes on the fore wings. On the costa are four yellow translucent spots, and in the centre two white ones. The hind wings have similar spots. The caterpillar is yellowish brown with twelve small black tubercles on each segment, each bearing a hair. The head is shining dark brown with a white cross upon it. It feeds on traveller's joy (*Clematis vitalba*).

THE SILKWORM, KENTISH GLORY, EMPEROR MOTHS, &c.

The Silkworm Moth (*Bombyx mori*) is originally a native of China, where it has been reared for the sake of its silk for many thousands of years. It is now scarcely known except in the domesticated form, and is a sluggish white moth, scarcely capable of flight. It expands about an inch and a half across the fore wings, which are slightly hooked at the tip, and are generally marked with one or two dusky lines. In the males the antennæ are pectinated. The caterpillar is whitish, with a horn on the back as in the *Sphingidæ;* but instead of burrowing in the earth it forms an egg-shaped white or yellow cocoon, which is the principal source from which the silk of commerce is derived.

The discovery of silk is attributed to a Chinese empress who lived more than 2000 years ago; but in the reign of Justinian eggs were smuggled to Constantinople, concealed in a cane, by two missionaries, since which time silk culture has been one of the staple industries of Southern Europe. Various attempts have been made without success to introduce it into the British Islands. The natural food of the silk-worm is mulberry, but it will also eat lettuce and other plants, and it is frequently reared in Britain for amusement, and eggs and silkworms are always to be obtained from dealers in insects, etc.

But the British climate is unsuited to the insect, and it is doubtful if it would ever be reared as a commercial success.

The Kentish Glory (*Endromis versicolor*), the male of which is figured on Plate 12, fig. 5, is a very handsome moth which, though local, is not very uncommon in large forests both in England and Scotland. The male is much smaller than the female, and the hind wings are tawny red; in the female the fore wings are greyer than in the male, and the hind wings are whitish. The caterpillar is very like that of a Hawk-moth, and has a triangular hump on the back in place of a horn. It feeds on the leaves of many forest trees, especially birch; and the pupa is enclosed in a stout cocoon, through the end of which it partly pushes itself when the moth is ready to emerge. The males fly through the woods very rapidly in search of the females, which may sometimes be found resting among the bushes, for, as in many butterflies and moths, the females are much more sluggish than the males. These moths are, however, best to be obtained in good condition by rearing from the caterpillar.

The Silkworm Moth and the Kentish Glory are sometimes placed together in the family *Bombycidæ*, but the Kentish Glory is more often regarded as the type and only representative of a special family, *Endromidæ*.

One of the handsomest of our larger moths is the Emperor, the only British representative of the magnificent family of the *Attacidæ* or *Saturniidæ*. The largest moth known is the great Atlas Moth of India, which sometimes measures very nearly a foot across the wings. In most of the species of this family we find a large transparent or ocellated spot, generally round or oval, in the middle of each wing, and the males are often smaller than the females, and provided with strongly plumose antennæ. In some cases, as in our British Emperor Moth (*Saturnia pavonia-minor*), the sexes are very differently coloured; but in some species there is little difference in this respect. The male measures about two and a quarter inches in expanse, and the female nearly three. The wings of the latter are of a light purplish grey, varied with whitish, and with a white border edged with light brown to all the wings; but the hind wings of the male are of a yellowish tawny. There is a conspicuous round spot consisting of concentric rings and crescents of brown, whitish, and yellowish in the centre of each wing. The female is sometimes found at rest among heath, on which the caterpillar feeds; but a newly emerged female in this and

many other species will attract males, if there are any in the neighbourhood. This mode of collecting is known as "assembling" or "sembling," and is often very productive. The caterpillar is a very beautiful creature, and is green, with pink warts bearing black hairs; and with orange spiracles. The cocoon is flask-shaped, and the moth pushes its way out at the narrow end. Two other allied species are common on the Continent, one of which, *Saturnia spini* (Plate 13, fig. 2), is very like our Emperor Moth, but both sexes are coloured nearly as in the female of our insect. The other moth, the Great Peacock (*Saturnia pavonia-major* or *pyri*, Plate 13, fig. 1), is the largest moth found in Europe, measuring nearly six inches across the wings, which are dark grey, but marked very much as in our Emperor Moth. The caterpillar is green, with blue warts, and feeds on fruit trees. The moth is found as far north as Paris and Vienna.

A third species, the Tau Emperor Moth (*Aglia tau*, Plate 13, fig. 3), which is common in beech woods in many parts of the Continent, is fulvous in the male and pale ochre-yellow in the female, with a blue spot on each wing ringed with black and containing a white T-shaped mark in its interior. The caterpillar is green with yellow dots and whitish lines. It feeds on various forest trees.

EGGAR MOTHS

These are large or moderate-sized moths which derive their name from their large egg-shaped cocoons. The males have generally strongly pectinated antennæ, and are often smaller and darker than the females, the prevailing colour of the males being brown or reddish, the females being more yellow. The moths have stout bodies, and the caterpillars are more or less hairy, and in some species gregarious.

One of the largest and most typical moths of this family (the *Lasiocampidæ*) is the Oak Eggar (*Lasiocampa quercus*, Plate 12, fig. 1), which measures two and a half or three inches in expanse of wing. It is chocolate-brown in the male, with a yellowish spot in a brown ring in the centre of each fore wing; and half-way between this and the border is a suffused yellowish band, which is continued on the hind wings. The female is yellowish tawny, with the yellowish band almost lost in the ground colour; but it is a rather variable insect. It is common in many places on heaths and open spaces, where the male flies with great rapidity in the daytime; but the males, like

those of the Emperor Moth, can readily be attracted by a freshly-emerged female. The caterpillar is blackish, with a white stripe on the back, and some white spots on the sides. Though named after the oak, it will also feed on bramble, heath, and a variety of other plants.

There are two other British species of *Lasiocampa* which are not rare, the Grass Eggar and the Fox Moth (*Lasiocampa trifolii* and *L. rubi*). They are rather smaller and more uniform in colour than the Oak Eggar, and the caterpillars, which are more or less black, generally feed on low plants.

The Drinker Moth (*Philhydoria* or *Cosmotriche potatoria*, Plate 12, fig. 2) is nearly as large as the Oak Eggar, and has yellowish wings, crossed by an oblique brown line, and the fore wings are marked with one or two pale yellow spots, bordered with pale brown. In the male the fore wings are tinged with reddish brown. In this moth the palpi project beyond the front of the head, forming a small beak. The caterpillar is blackish, with yellow stripes and white tufts, and there are black tufts of hair on the third and twelfth segments of the body. It is common on grass and is easily reared, but is not gregarious.

On the Continent there is a handsome species known as the Plum Eggar (*Odonestis pruni*, Fig. xiv.) which has a range from Central Europe to Japan. It is of a rich orange-red colour, with a white spot in the middle of the fore wings, and two dark transverse bands, one before and the other beyond the spot. Near the hind margins, which are dentated, is another less distinct but dentated transverse line. The caterpillar is bluish grey with yellowish longitudinal lines. It feeds on fruit trees and alder.

Fig. xiv. — Plum Eggar (*Odonestis pruni*).

The Small Eggar (*Eriogaster lanestris*, Plate 11, fig. 9) has rusty brown fore wings, with a white spot in the middle and another at the base. There is also a whitish stripe near the hind margin, continued on the paler hind wings. The male has a thick anal tuft. The caterpillar is blue-black with orange and white spots. It feeds on fruit-trees, etc.

Another allied British species is the December Moth (*Pœcilocampa populi* [see *Title page*]), which appears from October to

December. It has thinly scaled wings. The fore wings are purplish brown, with a yellowish transverse stripe near the base, and beyond the middle another zig-zag one. The hind wings are light grey, with a white transverse stripe. The grey caterpillar feeds on forest and fruit trees.

The smallest and one of the commonest moths of this family is the Lackey (*Clisiocampa* or *Malacosoma neustria*, Plate 11, fig. 8). The moth does not exceed an inch and a half in expanse, and is yellowish grey or reddish, with two pale lines on the fore wings. The eggs are laid in a ring round a twig, and the caterpillars are striped with red, blue, and yellow, and have a white line on the back. They are gregarious, and live on forest and fruit trees, under a web, scattering when they grow older, and are often very destructive.

We will pass over some of the other smaller moths of this family, but must mention the Lappet Moth (*Gastropacha quercifolia*, Plate 12, fig. 3), a large brown moth, two or three inches in expanse, which is remarkable for its strongly dentated wings, and its deceptive resemblance to a dried leaf, when at rest. The caterpillar is dark brown, with tufts of hair on the sides and two transverse blue bands near the front of the body. It feeds on sloe, willow, etc. The moth has a projecting beak, as in the Drinker Moth. It is not exactly a rarity, but cannot be called common.

An allied but smaller and paler moth, the Small Lappet (*Phyllodesma ilicifolia*), is a rarity on heaths, chiefly in the North of England ; the caterpillar is grey with a broad black line along the back, spotted with red ; and with white lines or marks on the sides. It feeds on bilberry, etc.

The Pine Lappet (*Dendrolimus pini*, Plate 12, fig. 4) is a common species on the Continent, though not found in this country, and frequents pine woods in summer. It has brown or grey wings, generally with the base and a central band reddish brown, with a white spot near the middle. The hind wings are deep reddish brown. The caterpillar is brown or grey, with reddish hair and a row of brown lozenge-shaped spots on the back. There is an interrupted brown stripe on the sides. It feeds on fir and pine.

THE HOOK-TIPS

The *Drepanulidæ* include several small moths with pectinated antennæ in the males, slender bodies, and broad wings ;

and as the fore wings are more or less hooked in most of the species, the moths are generally called Hook-Tips. The caterpillars are hairless, but more or less tuberculate, and as the terminal pair of legs (usually known as claspers) are obsolete, they have only fourteen legs. They feed on various trees, and the moths, like most slender bodied, broad-winged species, may easily be dislodged from their hiding-places in the daytime by beating hedges and bushes. They are generally double-brooded.

Most of the species are yellowish brown, with brown lines and mottlings ; and measure from an inch to an inch and a half in expanse. The fore wings are more or less pointed at the tip, and generally hooked, and the hind border is sometimes dentated.

The smallest species, however, the Chinese Character (*Drepana glaucata*), is an exception. It measures nearly an inch across the wings, which are white and rounded, with an irregular grey band, reticulated with silver, on the fore wings. The caterpillar is brown and tuberculate, and feeds on sloe.

Most of the British species of this small family are not uncommon, and are easily disturbed from bushes and herbage in open woods. We will mention two of these.

The Pebble Hook-Tip (*Drepana falcataria*, Plate 13, fig. 4) has ochre-yellow wings, with dark wavy lines and a grey spot in the middle of the fore wings, intersected by one of the lines. The caterpillar is reddish brown with a dark streak on the front of each segment.

The Scalloped Hook-Tip (*D. lacertinaria*, Plate 13, fig. 5) has pale-ochreous fore wings, dentated on the hind margins, with two straight dark transverse lines and a black spot in the middle. The caterpillar is brown with the sides sometimes greenish.

The caterpillars of both species feed on birch and alder.

INTERNAL FEEDERS AND SWIFTS

As a rule caterpillars live exposed on the leaves or branches of the plants on which they feed ; but many conceal themselves during the daytime, and some live beneath the surface of the ground, and feed on roots. Others, again, live and form their pupæ in the hollow stems of reeds, etc., or even in the solid substance of the trunk or branches of trees. These last are known as " internal feeders " ; and the moths bred from them are very liable to the fatty degeneration called " grease " by

collectors, which frequently exudes from the bodies of stout-bodied moths, spoiling the specimen and staining the paper of the cabinet drawers.

The largest and commonest of these internal feeders is the Goat Moth (*Trypanus* or *Cossus cossus*, Plate 28, fig. 9), belonging to the family *Zeuzeridæ*. It is a dark grey moth, with irregular black lines on the fore wings, and measures three or four inches in expanse. It derives its English name from the disagreeable smell of the caterpillar, which is a great reddish yellow creature with a black head, which lives for three years or more in the bark and wood of willows and other trees before it arrives at maturity, eating long galleries through them, and fixing its chrysalis in such a position that the freshly-emerged moth can easily push its way into the open air.

We have two other British species of this family, one of which, the Wood Leopard (*Zeuzera pyrina*, Plate 28, fig. 10), is commoner than is generally supposed in orchards round London and elsewhere, and is sometimes injurious to fruit trees. The moth expands two inches or more, and is white, with many blue-black spots on the body and fore wings, and a few on the hind wings. The yellow, black-spotted caterpillar feeds in the branches of various fruit and forest trees.

The only other British representative of the *Zeuzeridæ* is the Reed Leopard Moth (*Phragmatæcia castaneæ*), a moth with long narrow wings averaging an inch and a half in expanse, and a long slender body; in the male the wings and body are broader and shorter than in the female, and the antennæ are strongly pectinated. The fore wings are brownish grey, and the hind wings grey or whitish. The caterpillar is yellowish, and feeds in the stems of the reed. It is still met with in the English Fens, though much less common than formerly.

Another interesting family of internal feeders is that of the Clearwings (*Ægeriidæ*), which used to be classed with the *Sphingidæ* on account of the shape of their antennæ, but are now considered to be more nearly allied to the *Pyrales* or *Tineæ*. They are of small size, and the wings are more or less transparent, with dark borders, and the bodies are banded with black, red, and yellow. They are extremely likely to be overlooked on account of their great superficial resemblance to small wasps; and although they often fly by day, they are best obtained by studying their habits and rearing them from

the caterpillars. The commonest and most easily observed is the Hornet Clearwing (*Ægeria* or *Trochilium apiformis*, Plate 28, fig. 4,) which may be found sunning itself on the trunks of poplars in early summer. It measures about an inch and a half in expanse, and is yellow, with black bands and spots, and looks almost exactly like a hornet. The whitish caterpillar lives in the roots and lower part of the trunks of poplars. The larva of a very similar species, the Lunar Hornet Clearwing (*Ægeria* or *Trochilium crabroniformis*), feeds on sallow, and is found in osier beds; and unlike most other insects, much more abundantly (though always local) in England than on the Continent.

The other moths of this family are much smaller, and have a large tuft of hair, differing in colour in different species, at the extremity of the body. About a dozen species occur in Britain. One is the Dusky Clearwing (*Ægeria* or *Memythrus vespiformis*), which is blue-black, with yellow spots and belts. It differs from all the other British species in the fore wings being brown, and only the hind wings transparent, with brown borders; it measures about an inch and a quarter in expanse. The caterpillar, which is flesh-coloured with a brown head, feeds in the stems of poplar and aspen. The moth is exceedingly rare in Britain, but single specimens are taken occasionally here and there in the South of England; it is probably overlooked by collectors.

The only species which is really common in this country is the Currant Clearwing (*Ægeria* or *Sesia tipuliformis*, Plate 28, fig. 6), which measures nearly an inch across the wings. These are transparent, with blackish borders and central spot, slightly marked with orange. It has three or four yellow belts on the body. The caterpillar lives in the pith of the currant, and is common and often injurious in gardens.

The caterpillars of the Clearwings mostly live in the stems of trees and shrubs, but some feed on low plants; thus the caterpillar of *Ægeria* or *Sesia muscæformis* feeds in the roots of the sea-thrift. The moth is smaller than the Currant Clearwing, and the fore wings are darker, and the body is belted with white.

The Welsh Clearwing (*Æ.* or *S. scoliæformis*, Plate 28, fig. 5) has transparent wings, with dark brown fringes and transverse band. The head and antennæ are blue-black, the latter tipped with yellowish. The tegulæ and the second and the fourth abdominal segments are edged with yellow, and the anal tuft

is orange-coloured. It is local in Northern and Central Europe, and has in this country only been taken in Wales and Scotland. The caterpillar is cylindrical, dirty white in colour, with a yellowish brown cervical plate. It lives in the lower portions of old birch trees and forms galleries between the wood and the bark.

The Red-belted Clearwing (*Æ.* or *S. myopæformis*, Plate 28, fig. 7) has the costa, median band and hind margins of the fore wings blue-black, as well as the antennæ and anal tuft. The abdomen is also blue-black, with the fourth segment red. It frequents orchards, but is rather local in this country. The caterpillar is pale yellow, with a reddish tinge, with a dark reddish brown head and cervical plate. It lives under the bark of apple trees.

The Six-belted Clearwing (*Æ.* or *S. ichneumoniformis*, Plate 28, fig. 8) has transparent fore wings, with a median band which is dark on the inner side and saffron-yellow on the outer; the hind margin and the inner margin are likewise saffron-yellow. The costa is dark brown. The abdomen is black with the lower edges of the segments yellow, and there is a black and yellow anal tuft. The caterpillar is ivory-white, with black marks on the head. It feeds in the roots of Rest-harrow (*Ononis spinosa*).

We meet with many internal feeders belonging to the great group of *Noctuæ*, or night-flying moths, but these properly belong to the next section of our work, so we will defer our notice of them. But there still remain two small families usually referred to the group of *Bombyces*, which it will be convenient to include in this section. The first of these is the *Hepialidæ*, which includes the Ghost Moth (*Hepialus humuli*, Plate 28, fig. 11), and the Swifts. The whitish or yellowish caterpillar feeds on the roots of hop, dock, fern, dandelion, etc., below the surface of the ground. The moth generally measures two inches or more across the wings, which are white above in the male and brown below; in the female the upper surface is yellowish, with red markings. In the Shetlands a variety called *thulensis* is met with, in which the male assimilates more or less to the female in colour. The Ghost Moth has a heavy flight, and is very common in meadows on summer evenings, when the white male is very conspicuous. The moths of this family have all long narrow wings, and very short antennæ; the other British species are generally smaller than the Ghost.

The Common Swift (*Hepialus lupulinus*) measures only

an inch or an inch and a half across the wings, which are brown, more or less marked with whitish on the fore wings. It flies rapidly just over the grass in meadows in the evening. The caterpillar is cream-coloured with a brown head, and brown plates on the front segments. It feeds on various low plants.

The Wood Swift (*H. sylvinus*, Plate 28, fig. 12) has generally orange fore wings in the male, but the colour is very variable. There are two white transverse lines, edged with dusky, which approach one another towards the inner margin, and between these is commonly a small white curved line near the costa. The hind wings are dark brown, reddish towards the hind margin. The wings of the female are grey, with similar markings to those of the male. The caterpillar is cream-coloured, with an orange-coloured head, and tubercles with reddish brown hair on the back. It feeds on sorrel. Both this and the next species are common near woods.

The Golden Swift (*H. hectus*, Plate 28, fig. 13) has reddish brown fore wings, with a pale oblique streak before the middle and an interrupted series of similar spots in front of the hind margin, which are surrounded by silvery white and black in the male, and are light grey and wider in the female. The hind wings are dark grey. The caterpillar is dingy grey, with the anterior segments darker, with two black spots on the back of each segment, the head and anal plate being brownish ochreous. It lives in the roots of heath, primrose, sorrel, and other low plants.

There are only two British, or, indeed, European, species of the family *Limacodidæ*, which are occasionally found resting on leaves in woods; the caterpillars are green and slug-shaped, and feed in oak, beech, etc. The largest and prettiest of these is the Festoon Moth (*Apoda avellana* or *Cochlidion limacodes*, Plate 27, fig. 17), which measures about an inch in expanse. The male has ochre-yellow fore wings and brown hind wings, and the female is more uniformly ochre-yellow; the fore wings are crossed by two brown lines, approximating in front and diverging behind.

The other species, the Triangle Moth (*Heterogenea cruciata*), has dark brown fore wings, and nearly black hind wings in the male, and light brown fore wings and dark brown hind wings in the female.

The caterpillars of some of the exotic species of this family are clothed with hairs which sting very severely.

THE NOCTUÆ OR NIGHT-FLYING MOTHS

This is an extensive group of moths of moderate size (an inch and a half being about the average measurement, though many are larger, and some smaller) and usually of dull colours. Most of the species have moderately stout bodies, and fly at night or at dusk; though some few fly by day, like butterflies. Most of their caterpillars have the normal number of sixteen legs, though the caterpillars of some species are what are called "half-loopers," having one or more pairs of prolegs imperfectly developed.

We have upwards of three hundred species of this group in England, divided into a number of more or less distinct families, the classification of which cannot yet be considered to be finally settled.

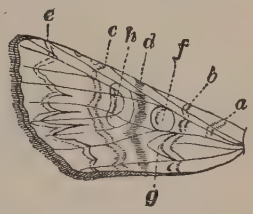

Fig. xv.—Noctua Pattern.

(*a*) Half line, (*b*) Anterior, and (*c*) Posterior transverse line; (*d*) Central shade; (*e*) Submarginal or subterminal line; (*f*) Orbicular stigma; (*g*) Claviform stigma; (*h*) Reniform stigma.

The markings of the fore wings are generally described as the *Noctua*-pattern (Fig. xv.), and when fully developed consist of the so-called half-line (*a*) near the base; the anterior (*b*), and posterior (*c*) transverse lines, enclosing the central area between them, in which are three spots called stigmata. One of these is the orbicular stigma (*f*), another is the reniform (*h*) placed nearer the costa, whilst the claviform (*g*) is nearer the inner margin of the wing. In addition to these there is often a pale band passing through the central area which is called the central shade (*d*). In the submarginal area there often runs a zig-zag line more or less parallel to the hind margin; this is the submarginal or subterminal line (*e*).

The moths of the family *Acronyctidæ* are most often seen at rest on the trunks of trees. They measure about an inch and a half in expanse, and the fore wings are grey or whitish, with brown markings, or brown with grey markings, and the hind wings, which are smaller and more slender than the fore wings, are grey or brown. The caterpillars feed on various trees. Among the commoner species are the Dagger Moths (*Acronycta tridens* and *A. psi*, Plate 14, fig. 3), which have grey fore wings, with brown markings, including one resembling the Greek letter ψ near the hinder angle of the fore wings. The caterpillars are dark grey with pale lines. They feed on sloe, hawthorn, etc.

The Sycamore Moth (*Acronycta aceris*, Plate 14, fig. 2) is similar, but the fore wings are irregularly varied with brown, without the conspicuous dark markings of the Daggers. The caterpillar is yellow with cream-coloured hair and a white line along the back edged with black, below which are tufts of orange hair. It feeds on sycamore, chestnut, poplar, etc.

The Miller (*A. leporina*) is the palest of the family, being light grey or whitish, with a few dark spots on the fore wings. The caterpillar is green with white hair and with four black tufts on the back; it feeds on willow, alder, etc.

The Knot-grass Moth (*A. rumicis*, Plate 14, fig. 4) has brownish grey fore wings shaded with lighter and darker, with a row of indistinct whitish curved lines before the hind margin, and a white crescentic spot near the inner margin. The hind wings are light grey. The caterpillar is dark brown with reddish yellow hairs, with a white stripe on the sides, spotted with red, and white spots on the sides of the back. It feeds on sorrel and other low plants.

The Scarce Marvel-du-Jour (*Diphthera alpium*, Plate 14, fig. 1) has light green fore wings, with three white longitudinal streaks and three black transverse lines and two spots. The hind wings are greyish brown with two white blotches at the anal angle. The caterpillar is black with three large reddish yellow spots on the back, and numerous red tubercles with yellow tufts of hair. It feeds on oak and beech.

Among the European species we may mention *Bryophila raptricula* (Plate 15, fig. 9), whose range does not extend to the north-west of Europe. The fore wings are violet-grey, with the transverse lines only partially developed and joined by a dark longitudinal line. The hind wings are light grey. The caterpillar is leaden-grey, with two white dorsal lines bordered with orange and with black dots. It feeds on a fungus called *Sticta pulmonaria*.

The caterpillars of the *Leucanidæ* or Wainscots feed on grass, low plants, and reeds, hiding themselves during the day, and several of them are very common. Most of the species are somewhat similarly coloured, those of the genus *Leucania* having reddish brown fore wings, indistinctly streaked longitudinally with paler, and often with a white spot in the middle; the hind wings are whitish or brown.

To this genus belongs the Common Wainscot (*Leucania pallens*, Plate 16, fig. 12), with pale ochre-yellow fore wings. The caterpillar is reddish or yellow with a dingy white

dorsal line edged with cream-colour. It feeds on sorrel and dandelion.

Leucania l-album (Plate 16, fig. 13) has tawny yellow fore wings, with a black streak at the base and a brown longitudinal shade, which extends to the tip; on the median nervure is a thick white line, hooked towards the costa. The caterpillar is yellowish brown with two contiguous dark lines along the back, and two dark green lines along the sides. It feeds on grasses and sorrel.

An allied species, *Luceria virens* (Plate 16, fig. 11) has green fore wings, with a white central lunule and white hind wings tinged with greenish. The caterpillar is dark brown with black-tufted warts, and feeds on plantain and grass roots.

The Treble Lines (*Grammesia trigrammica*, Plate 17, fig. 1) is distinguished by its yellowish grey fore wings, crossed by three straight rusty brown transverse lines. The caterpillar is violet-brown with two oblique black streaks on the back of each segment and a pale line on the sides. It feeds on grass, plantain, and other low plants.

The White-line Rustic (*Caradrina alsines*, Plate 17, fig. 2) has ochreous brown fore wings, with brown transverse lines, the outer one being broken up into a row of dots. The submarginal line is pale, shaded with darker on the inner side. The orbicular and reniform stigmata are large and dark, surrounded with whitish. The hind wings are brownish grey. The caterpillar is clay-coloured, with three pale grey lines on the back, bordered with darker. It feeds on plantain, nettle, sorrel, etc.

The species of *Nonagria* are more grey and most of the caterpillars are internal feeders, feeding in the stems of grass and reeds, and are consequently chiefly to be found in fenny districts, and are usually very local. Some species, however, are commoner and more generally distributed; the smaller ones do not measure more than an inch in expanse, but some species are twice as large, and among these is the Reed Moth (*Nonagria arundinis* or *typhæ*, Plate 16, fig. 10), which is common in many places among the Reed Mace (*Typha latifolia*). Its flesh-coloured caterpillar feeds in the stems of this plant, in which the chrysalis is often to be found.

We now come to several rather extensive families, mostly including dull-coloured night-flying species of moderate size, which are among the most typical of the *Noctuæ*. The first of these is that of the *Apameidæ*, several of which are very common.

Many of the species may be seen flying over flowers in the evening, but some may be met with occasionally resting on flowers in the daytime. One of these is the most brightly-coloured insect in the family, the Frosted Orange (*Gortyna flavago* or *ochracea*, Plate 16, fig. 9). It measures nearly an inch and a half across the fore wings, which are dull orange-yellow, varied with brown, with pale yellow stigmata ; the hind wings are whitish. It is interesting because the caterpillar is an internal feeder, living in the stems of thistles, burdock, and similar plants, in which also it forms its chrysalis. The caterpillar is whitish, with black tubercles and a yellowish brown head.

The Barred Sallow (*Gortyna* or *Xanthia aurago*, Plate 17, fig. 10) has violet-brown fore wings with a golden yellow central area and apical spot, and violet-brown orbicular and reniform stigmata surrounded with lighter. The caterpillar is pale reddish brown with a white line along the back bordered with dusky. It feeds on beech.

The Sallow Moth (*G.* or *X. fulvago*, Plate 17, fig. 11) is somewhat similar. It has lemon-yellow fore wings, with rusty brown spots and indistinct markings. The subterminal line is represented by a row of dots. The caterpillar is greyish brown with a white line, grey lateral stripe and oblique blackish streaks. It feeds on beech.

The Orange Upper-wing (*Hoporina croccago*, Plate 17, fig. 12) has bright orange-red fore wings dusted with brown, with indistinct transverse lines, the subterminal line being dark brown. The orbicular and reniform stigmata are surrounded with lighter, with a dark interrupted central shade between them, and four white streaks along the costa. The caterpillar is yellowish grey with dark brown angular spots on the back and a black transverse line near the extremity with two straw-coloured marks behind it. It feeds on oak scrub.

Another common species is the Golden Ear (*Hydræcia nictitans*, Plate 16, fig. 8). It has rusty brown fore wings, with fine dark brown double transverse lines and an indistinct subterminal line. The orbicular stigma is small and orange-coloured, as is also the small and often indistinct claviform stigma ; the reniform is white. The hind wings are brownish grey. The caterpillar is dingy ochreous-brown, with pale longitudinal lines and small black tubercles ; the head is yellow. It feeds on hair-grass.

Two moths of this family are extremely common in gardens etc., flying about in the evening and often entering rooms

One of these is a rather large moth, the Dark Arches (*Xylophasia polyodon* or *Hadena monoglypha*, Plate 15, fig. 12), which measures two inches across the wings. It is of a lighter or darker brown, more varied with grey; and the hind wings are grey, with a darker border. The wings are slightly dentated along the outer border, near which, as in many similar moths, runs a white line, forming a W towards its lower end. The fore wings and abdomen are rather long, and the abdomen is strongly tufted at the tip. The light brown caterpillar feeds on grass near the roots.

One of the most destructive moths in our kitchen gardens is the Cabbage Moth (*Mamestra brassicæ*, Plate 15, fig. 3). It is nearly as large as the last species, but the wings are less dentated, and the body is shorter. The fore wings are dark grey, slightly mottled with whitish, and with an irregular white mark in the middle. There is also a whitish W-shaped submarginal line. The hind wings are grey, paler towards the base. The caterpillar is brown, grey, or green, and will feed on a great variety of plants, though it is specially fond of cabbage, and is more destructive than the caterpillars of the white butterflies, for while the latter feed chiefly on the leaves and stalks, the caterpillar of the moth likes to eat into the cabbage itself, when it is much less easy of detection.

There are several moths very similar to the Cabbage Moth; the most conspicuous being the Dot (*Mamestra persicariæ*, Plate 15, fig. 4), which has blackish fore wings, with a clear white horseshoe-shape mark in the middle. The caterpillar, which is dingy green or greyish brown with a pale dorsal line and lighter and darker angular spots, feeds on low plants. The moth is not very scarce, though much less abundant than the Dark Arches or the Cabbage.

The Broom Moth (*M. pisi*, Plate 15, fig. 5) has shining reddish brown fore wings, with two yellowish transverse lines and a pale yellow submarginal line, merging into a triangular white blotch at the hinder angle. The orbicular and reniform stigmata are brownish grey. The caterpillar is brownish green, with four yellow stripes and a flesh-coloured belly. It feeds on various low plants, and is sometimes destructive to peas.

Among the smaller moths of this family we may mention the Minors (genus *Miana*). They are brown, grey, or reddish moths, which fly in the evening, and seldom measure much more than an inch in expanse.

The Marbled Minor (*Miana strigilis*, Plate 15 fig. 8) has

brown fore wings, with black transverse lines, bordered with white; the subterminal line is grey on a white band; and the stigmata are edged with whitish. The hind wings are brownish grey. The caterpillar is brownish ochreous, with a paler line on the back and two reddish ones on the sides. It feeds on grass stems.

The *Agrotidæ* include a large number of moths, measuring about an inch and a half across the wings. The species of *Agrotis* have brown fore wings and grey or light brown hind wings, while those placed in *Graphiphora* have the fore wings more tinged with reddish. This family, like the last, includes two very abundant and destructive garden moths, the Heart and Dart Moth (*Agrotis exclamationis*) and the Turnip Moth (*Agrotis segetum*). The former has brown fore wings with three conspicuous black spots, two irregularly roundish, and a thick black dash placed below the innermost of the others; the hind wings are white. The caterpillar, which is greyish brown with a light dorsal and dark lateral line, feeds on grasses. The Turnip Moth is very similar, but the black markings are less distinct and regular. The caterpillar is earthy grey with dark lines on the back, and feeds on turnip, corn, grass, etc.

The caterpillars of the genus *Agrotis* are generally grey, and feed on grass, dandelion, and all sorts of low plants, many of them feeding on the roots below the surface of the ground, whence they are known to American agriculturists as "cut-worms." Some of them will also eat into the substance of turnips and similar roots.

Some other British species are :—

The Setaceous Hebrew Character (*Agrotis c-nigrum*, Plate 14, fig. 9). This has violet-brown fore wings with a pale orbicular stigma bounded below by a black elongated mark. The caterpillar is brownish grey with oblique black dorsal streaks and a greyish yellow line on the sides, edged with black. It feeds on low plants.

The Flame Shoulder (*Agrotis plecta*, Plate 14, fig. 10) has also violet-brown fore wings with a broad ochre-yellow patch along the costa, bounded below with blackish. The orbicular and reniform stigmata are pale. The hind wings are white. The caterpillar is yellowish grey with three red lines on the back and a yellow one on the sides. It feeds on bedstraw.

The White-line Dart (*Agrotis tritici*, Plate 14, fig. 11) is a very variable species, but the following description may be taken as typical—fore wings grey, with double dark dentated

transverse lines, orbicular and reniform stigmata dusted with whitish, claviform shaded with blackish. The caterpillar is brownish grey with lighter longitudinal lines, and dark oblique streaks on the back. It feeds on grasses, etc.

The Double Square Spot (*Agrotis triangulum*, Plate 14, fig. 8) has brownish fore wings tinged with silvery, with a square black spot between the light orbicular and reniform stigmata, connected below with a small black triangular spot internal to the orbicular. The hind wings are greyish brown. The caterpillar is brown with three whitish lines along the back and reddish stripes on the sides. It feeds on low plants.

More conspicuous than these moths, but allied to them, are the Yellow Underwings, belonging to the genus *Triphæna*, of which there are several species. The Common Yellow Underwing (*T.* or *Agrotis pronuba*, Plate 14, fig. 7) measures about two inches across the reddish brown fore wings; the hind wings are bright yellow, with a moderately broad band close to the hind margin. The moth hides itself among long grass and weeds, and it is not uncommon for one to be flushed in a strawberry bed, or similar locality, when it darts away suddenly for a few yards, but soon pitches down on the ground in search of a fresh place of concealment. The caterpillar varies from dingy white to dark earthy brown, with three paler lines along the back, having thick black streaks between them. It feeds on low plants.

The Broad-bordered Yellow Underwing (*Triphæna* or *Agrotis fimbria*, Plate 14, fig. 6) is similar to *T. pronuba*, but has a broader marginal band on the hind wings. The caterpillar is brownish ochreous with a yellow dorsal and cream-coloured lateral line, and curved brown marks between, edged with white behind. It feeds on low plants, including primrose.

The Lesser Broad-border (*Triphæna* or *Agrotis ianthina* Plate 14, fig. 5) is smaller, expanding a little over an inch and a half. It has brown fore wings tinged with green, and yellow hind wings with a very broad black submarginal band. The caterpillar is reddish grey, with a pale grey line along the back; also oblique black streaks forming angles, and a pale line on the sides. It feeds on primrose, and other low plants.

One of the earliest signs of spring is the flowering of the sallow bushes, round which bees and other insects cluster in the daytime, while at dusk they are visited by numerous species of moths, sometimes in great abundance. Many of these belong to a family of *Noctuæ* called *Orthosiidæ*. Most of the

species are of rather small size (generally under an inch and a half in expanse), and are brown or grey, with inconspicuous lines and markings. They belong to the genera *Cuphanoa* (or *Tæniocampa*), *Orthosia*, etc., and are popularly called "Quakers."

Fig. xvi.—Heart Moth (*Dicycla oo*).

The Heart Moth (*Dicycla oo*, Fig. xvi.) has pale yellow fore wings, with the base brown, with brown transverse lines, the middle one expanding beneath the reniform stigma. The three stigmata are all edged with brown, and the reniform contains a brown streak. The hind wings are whitish, lightly dusted with grey on the hind margin. The moth is widely distributed in Central Europe, but is local in the South of England. The caterpillar is reddish brown, with white lines and spots and a black head. It feeds on oak.

The Pine Beauty (*Panolis piniperda or griscovariegata*, Plate 17, fig. 7) has the fore wings varying from rusty brown to brick-red, with the nervures partially dusted with grey; the transverse lines are brownish red, bordered with white, and the two stigmata are large and whitish, with the interior olive-brown. The hind wings are brownish black. The caterpillar is slender, smooth and green, with three white or yellowish dorsal lines and a reddish lateral line. It feeds on fir and pine.

The Hebrew Character (*Tæniocampa gothica*, Plate 17, fig. 5) is a very characteristic species. The fore wings are brownish grey, with fine white transverse lines, and a pale submarginal line. Below the reniform stigma is a black longitudinal mark, and the space between the yellow-edged orbicular and reniform stigmata is also black. The hind wings are brownish grey. The caterpillar is green with three pale yellow dorsal lines, and a broad lateral line. It feeds on lime, oak, sloe, and low plants.

The Common Quaker (*T. stabilis*, Plate 17, fig. 6) has rusty yellow fore wings, with a row of black dots beyond the outer transverse line, a whitish submarginal line, and stigmata surrounded with paler. The hind wings are yellowish grey. The caterpillar is green, finely dotted with yellowish, with five yellowish lines on the back and a yellow transverse line on the penultimate segment. It feeds on oak and beech.

The Antler Moth (*Charæas graminis*, Plate 15, fig. 1) has ochreous grey or brownish red fore wings, with indistinct transverse lines, and three pale stigmata. The hind wings are

brownish black. The caterpillar is stout, smooth, and clay-coloured, with three pale dorsal lines and black cervical and anal plates. It is often very destructive to grass, on the roots of which it feeds.

The Flounced Rustic (*Orthosia helvola*, Plate 17, fig. 9) has reddish brown fore wings, dusted with grey, with the central marginal areas dark rusty yellow. The transverse lines are pale, bordered with brown lunules, as is also the yellowish submarginal line. The orbicular and reniform stigmata are surrounded by yellowish white. The hind wings are brownish grey. The caterpillar is rusty brown with a dingy line on the back and a broad white stripe on the sides. On each segment there are from four to six white dots. It feeds on oak, bilberry and heath.

Other moths of this family are reddish in colour and are called "Chestnuts"; while the species of *Gortyna* (known as Sallow Moths) are mostly yellow, with purplish markings. The bodies of these moths are stout and hairy, and hardly longer than the hind wings. The wings are moderately broad, and obtusely rounded towards the extremities. The caterpillars feed on trees and bushes. Most of the species appear in early spring, and are to be found on sallow blossoms; many may also be found in late autumn at ivy blossom. One of the largest and most interesting representatives of this family is the Satellite Moth (*Eupsilia* or *Scopelosoma satellitia*, Plate 18, fig. 1), which is one of those which is common both in spring and autumn. It measures nearly two inches in expanse, and is reddish brown with a conspicuous white or yellow spot in the middle of the fore wings, at each end of which are two dots of the same colour. The caterpillar is brown, with more or less distinct white lines and spots, and feeds on trees. But, like several other caterpillars, it is one of those which is known as a "cannibal," and will ferociously devour any caterpillars of its own or any other species which may come within its reach.

We meet with Cannibal Caterpillars in the small family of the *Cosmidæ*, especially in the commonest species, which is known as the Dun Bar (*Cosmia* or *Calymnia trapezina*, Plate 17, fig. 8). The moth generally measures rather less than an inch and a half across the fore wings, which are of a rather shining yellowish grey, or reddish, with the central portion darker, and bounded by two brown lines, edged with lighter, far apart on the front edge of the wing, and converging, but not meeting, on the lower

margin; near the middle of the wing is a small brown dot. The hind wings are brownish grey. The caterpillar is green, with white lines and black dots, and is common on various trees, but is very fond of devouring other caterpillars.

Fig. xvii.—Angle-striped Sallow (*Cosmia paleacea*).

The Angle-striped Sallow (*Cosmia paleacea*, Fig. xvii.) has pale ochreous or reddish ochreous fore wings, with three brown transverse lines, the middle of which touches the lower part of the reniform stigma, which has a dark nucleus. The two stigmata are surrounded with brown. On the hind margin there is a row of brown dots. The hind wings are yellowish white. It is a local species in Central Europe, including the British Islands. The caterpillar is dull yellowish green, with white lines and a brownish head. It feeds on aspen, birch, and alder, between leaves spun together.

The Green Arches (*Aplecta herbida*, Plate 14, fig. 12) has yellowish green fore wings, varied with brown, with brownish stigmata, and a large white spot beyond the reniform stigma. The transverse lines are pale, edged with black. The hind wings are brownish grey. The caterpillar is pale grey, with three light dorsal lines, with large black spots between them. It feeds on primrose, bilberry, etc.

The species of *Dianthœcia* have grey fore wings, varied with brown, or brown ones varied with grey; they expand nearly an inch and a half, and the various species are found flying over flowers in the evening. Their grey or yellow caterpillars feed in the seed-capsules of different species of Campion, Catchfly, etc., and the moths are only to be looked for where such plants are common, especially on the sea coast.

The Varied Coronet (*Dianthœcia compta*, Plate 15, fig. 6) has brownish grey fore wings, with a broad white transverse band, and brownish grey hind wings. The caterpillar is reddish grey with a brown stripe on the back, and a yellowish line on the sides. It feeds in the seed capsules of catchfly and pinks.

The Lychnis (*D. capsincola*, Plate 15, fig. 7), which is the commonest of the genus, has greyish brown fore wings and a white submarginal line, which forms a distinct W, and has black wedge-shaped spots internal to it. The two transverse lines are dark; the orbicular and reniform stigmata are

surrounded with white, and the claviform is dark brown. The hind wings are brownish grey. The caterpillar is brownish grey with brown angular marks on the back, and a brown line on the sides. It feeds in the seed capsules of red campion.

The species of *Hadena* are brown or grey moths, generally larger than the *Dianthœcias;* they have a white W-like line near the hind margin of the fore wings, similar to that which we meet with in the Cabbage Moth and its allies in the *Apameidæ*.

Among the larger and more conspicuous moths of this family we may mention two which measure nearly two inches across the wings, but which differ much in shape and colour. The Marvel-du-Jour (*Dichonia aprilina*, Plate 16, fig. 1) has regularly rounded wings of a light green colour, with more or less continuous zig-zag black lines and angulated spots edged with white; and dark grey hind wings. The caterpillar is pale grey, with a white line along the back, and dark brown confluent spots, and with a dark brown stripe on the sides, spotted with white; it feeds on oak, and on fruit trees, hiding in crevices in the bark during the day.

The Feathered Gothic (*Epineuronia popularis*, Plate 15, fig. 2) is a common but characteristic species. The fore wings are brown, with whitish nervures, and a white submarginal line, with black triangular spots on the inner side. The orbicular and reniform stigmata are dark internally, surrounded with lighter, and the claviform is brown, with a light central streak. The hind wings are dirty white, with brownish grey margins. The caterpillar is dark brown, spotted with black, with a light grey stripe on the sides. It feeds on grasses.

A *Noctua* which is not uncommon in Central Europe and Western Asia, is *Ammoconia cæcimacula* (Plate 15, fig. 13). It has pale greenish brown fore wings, with a deep black streak in the middle of the internal transverse line, a brown finely dentated submarginal line, and orbicular and reniform stigmata finely bordered with brown. The hind wings are greyish white in the male, with dark marginal spots, and uniform grey in the female. The caterpillar is greenish brown, dotted with dusky above, with three brown lines, and with a whitish line on the sides. It feeds on dandelion and other plants.

Valeria oleagina (Plate 15, fig. 11) has dark violet-grey fore wings, dusted in places with moss-green, and with moss-green hind margins. The reniform stigma is whitish, containing a small dark spot above and below. The hind wings are whitish

with brown margins. The antennæ are finely pectinated, the pectinations being long in the male. It is found in various parts of Central Europe. The caterpillar is brownish grey, darker on the back, with paler oblique streaks, and an orange-red cervical band; it feeds on sloe and hawthorn.

The Large Ranunculus (*Polia flavocincta*, Plate 15, fig. 14) is a common European species, which is also found in England. The fore wings are grey, with the central area dark brownish grey, with two dark transverse lines, and with orange-coloured spots representing the submarginal line, bordered internally with dark arrow-headed spots. The hind wings are yellowish grey, with two dark transverse bands. The caterpillar, which is green with a dark green dorsal and yellow lateral line, feeds on wormwood and sorrel.

A very elegant *Noctua* is *Jaspidea celsia* (Plate 16, fig. 7), an inhabitant of Northern and Eastern Europe. It has apple-green fore wings, with a yellowish brown central band and hind margins, and brownish grey hind wings. The caterpillar is yellowish grey, with minute black tubercles, and brown cervical and anal plates. It feeds on grasses.

The Orache Moth (*Trachea atriplicis*, Plate 16, fig. 3) has greyish brown fore wings, marbled with moss-green, with fine black transverse lines, and a whitish submarginal line, bordered with green. The three stigmata are also edged with moss-green; below the orbicular and reniform is a large white spot shaped like a tooth. The hind wings are dark grey. It is common in most parts of Europe, but is somewhat local in England. The caterpillar is reddish brown, with two pale grey lines on the sides with a yellow stripe below them, and two yellow spots at the extremity. It feeds on sorrel, orache, knot-grass, etc.

The Bird's Wing (*Dipterygia scabriuscula*, Plate 16, fig. 2) has blackish brown fore wings, with black transverse lines, the outer being edged with white and forming wide curves. The three stigmata are indistinct and surrounded with black; the hind margin and the adjoining portion of the inner margin is light brown, shaped like the wing of a bird. The hind wings are greyish brown. The caterpillar is reddish brown, clouded with dusky, with a fine white line on the back edged with brown, oblique brown streaks below it, and a brown line on the sides edged below with white. It feeds on low plants.

The Small Angle-shades (*Euplexia lucipara*, Plate 16, fig. 4) has violet-red fore wings, with the central area dark brown,

with black transverse lines and a pale slightly zig-zag submarginal line, marked with two black dots near the apex. The orbicular stigma is dark bluish grey, and the reniform yellowish white. The hind wings are brownish grey, lighter at the base. It is a common species both with us and on the Continent. The caterpillar is green, with dark angular marks on the back, and a suffused white line on the sides. It feeds on raspberry, bramble, nightshade, etc.

The Angle-shades (*Habryntis* or *Brotolomia meticulosa*, Plate 16, fig. 5) is common, but it is one of the handsomest of our *Noctuæ*. The fore wings are rather long, and are of a rosy grey, with the centre varied with greenish, and bordered by two pale lines wide apart on the front edge, and converging, but not meeting, on the hinder edge; the hind wings are yellowish white. The caterpillar is green or brown, with an interrupted white line on the back, and dark oblique streaks, and whitish stripes on the sides. It feeds on dead-nettle, sorrel, and other low plants.

The family *Cucullidæ* is best represented by the moths of the typical genus *Cucullia*, which are popularly known as Sharks. They measure an inch and a half or two inches across the wings, which are very long, narrow, and pointed, and the thorax is crested. They are light brown or grey, almost wood-coloured, with hardly any markings, and they fly over flowers in the evening like small Hawk-moths, to which they have some superficial resemblance. The caterpillars are whitish or green, with yellow spots and markings; or yellow or blackish may predominate; and they feed gregariously on mullein, wormwood, sow-thistle, chamomile, etc. Some of the Continental species not found in Britain are much more brightly coloured than ours, being beautifully adorned with green or bright silvery markings.

The Water Betony Shark (*Cucullia scrophulariæ*, Plate 18, fig. 6) has the fore wings broadly bordered with chestnut-brown on the costa and inner margin, and has the hind margin dentated. The hind wings are white in the male, with dark grey margins, and darker in the female. The caterpillar is bluish or greenish white, with a yellow band and black marks on each segment. The head is yellow. It feeds on mullein and figwort.

The Common Shark (*C. umbratica*, Plate 18, fig. 7) has narrow fore wings, of a pale ashy grey, darker in the female, with black longitudinal streaks and blackish nervures. In

the position of the reniform stigma is a yellow blotch. The hind wings are whitish in the male, with the nervures and hind margin dusted with brownish grey; and are brownish grey in the female. The caterpillar is reddish brown, thickly dotted with black, with more or less distinct reddish yellow lines along the back and one above the legs; the head is dull black. It feeds on sowthistle.

The following two species are found in Central and Southern Europe except the west.

Cucullia lucifuga (Plate 18, fig. 8). This has dark violet-grey fore wings, with a black streak at the base and a black anterior transverse line. The black on the nervures is expanded in the marginal area. The hind wings are whitish in the male with pale greyish brown margins, and are uniform greyish brown in the female. The caterpillar is dark brown or black, with three rows of pale red spots, and a shining black head. It feeds on carrot, sowthistle, etc.

The Green Silver Spangle (*C. argentea*, Plate 18, fig. 9) is very distinct from the foregoing. The fore wings are green, with the base, marginal band, orbicular and reniform stigmata silvery. There is also a large silver spot in the central area and one near the apex. Through the stigmata runs a dark green streak. The hind wings are white. The caterpillar is green with a yellow line on the back and a white one on the side; on each side are brown warts. It feeds on wormwood.

The *Xylinidæ* are a small family of moderately large moths, with elongated fore wings, which hibernate in the perfect state. The colour of the fore wings is grey or brown, with more or less distinct stigmata. The caterpillars enter the earth to form the chrysalis.

The Conformist (*Xylina furcifera*, Plate 18, fig. 2) has dark violet-grey fore wings, varied with brownish, with indistinct dark transverse lines, edged with paler, and a suffused submarginal line. The three stigmata are distinct; the reniform being very large, rusty red in its interior and broad below, and edged with black; the claviform is surrounded with dusky, with a black longitudinal streak reaching to the anterior transverse line, and another at the base. The hind wings are dark brownish grey. On the third segment of the abdomen there is a strong tuft. The caterpillar is green with yellow longitudinal lines, or greyish brown with five pale grey longitudinal lines, of which the three on the back are interrupted by

a black streak on each segment. It feeds on alder and birch, hiding in the day.

The Grey Shoulder-Knot (*X. ornithopus*, Plate 18, fig. 3) has the fore wings whitish grey, with indistinct transverse and subterminal lines; a black triangular streak at the base; and the three stigmata surrounded by black, the claviform being brown internally. The hind wings are brownish grey. It is common in most parts of Europe, including the British Islands. The caterpillar is green, with five white longitudinal lines, and is densely covered with white dots; it feeds on sloe and oak, and is a cannibal.

The Red Sword-grass (*Calocampa vetusta*, Plate 18, fig. 4), which expands two inches or a little more, is common in Central Europe, including the British Islands. The fore wings are light brown in the costal half, dark brown towards the inner margin, and whitish towards the base. The markings are indistinct. The reniform stigma is surrounded with black, centred with white, with a dark shade in the outer border, from which a black streak extends to the pale subterminal line. The hind wings are brownish grey. The caterpillar is green with two yellow lines along the back enclosing a row of white dots, a yellow line on the sides, edged above with brown, and red stigmata. It feeds on flag and knot-grass.

The Flax Moth (*Calophasia lunula*, Plate 18, fig. 5) is a small moth measuring from one to one and a quarter inch in expanse of wings. It has fawn-coloured fore wings, varied with whitish grey, with distinct double transverse lines, filled in with white. The orbicular and reniform stigmata are small and whitish, edged with black. The hind wings are brownish white, with broad dark margins. It is common and widely distributed in Central Europe, but is not British. The caterpillar is greyish white with yellowish longitudinal lines, black transverse spots on the back, and black dots on the sides. It feeds on flax.

The remaining British *Noctuæ* belong to comparatively small families, but contain many interesting species, some of them of large size, or varied colours, and a considerable number of which are day-flying species. A few of these we will now notice.

Most of the species of the family *Heliothidæ* fly over clover and other flowers in the daytime. These belong to the typical genus *Heliothis*. They measure an inch and a quarter or an inch and a half in expanse, and the fore wings are light brown, varied with grey or yellowish brown, and the hind wings are

greyish white, sometimes marked with brown towards the base, and with a brown border interrupted with white. The most noteworthy of these moths are the Marbled Clover Moth and the Scarce Bordered Straw.

The Marbled Clover (*Heliothis dipsacea*, Plate 18, fig. 11) has yellowish grey fore wings, varied with brownish grey markings; and pale yellow hind wings, with a black central spot and hind margins, the latter with a pale yellow spot in the middle. The caterpillar is greyish green, or yellowish or reddish grey, with white dorsal and lateral lines; it feeds on chicory, rest-harrow, larkspur, etc.

The Scarce Bordered Straw (*Heliothis armiger*) has brownish ochreous fore wings, varied with darker. It is a very scarce insect in Britain, but is found in most parts of the world. The caterpillar is green or brown, with white or yellowish stripes. It feeds on a great variety of plants, and will also devour other caterpillars. It is a terribly destructive insect in North America, where Dr. Holland says of it: "It is a very promiscuous feeder, and shows a special fondness for young Indian corn in the ear, and for cotton balls. . . . It attacks the fruit of the tomato when still green, and causes it to rot on the vines. It also feeds upon pumpkins, peas, beans, hemp, and, it is said, upon tobacco."

The Pease-blossom Moth (*Chariclea delphinii*, Plate 18, fig. 12) has rather pointed fore wings, of varied paler and darker violet-red, with dark transverse lines edged with light on the inner side, and a pale submarginal line. The hind wings are whitish with a small grey central lunule, and broad or brownish grey marginal band. It is very rare in this country. The caterpillar is violet-grey dotted with black, with a black interrupted dorsal line bordered with yellow, and a yellow lateral line. It feeds on larkspur.

The Bordered Sallow (*Pyrrhia umbra*, Plate 18, fig. 13) has brownish golden yellow fore wings, with broadly violet-brown hind margins. The transverse lines and the submarginal line are dark brown and the orbicular and reniform stigmata are surrounded by dark brown. The hind wings are yellowish, with a small central lunule and broad dark grey margins. It is local in the British Islands, though common in Central and Southern Europe. The caterpillar is dingy green or reddish brown, with four white longitudinal lines, and a brown dorsal one, dotted with black; it feeds on rest-harrow.

There are several smaller and prettier moths of the family

Anartidæ, two of which are common in Britain, and both have yellow hind wings, broadly bordered with black. One of these is the Beautiful Yellow Underwing (*Anarta myrtilli*, Plate 18, fig. 10), which measures about an inch in expanse. The fore wings are vinous red, with white lines, and a white spot in the middle. It flies rapidly in the sunshine on heaths, where its caterpillar, which is green, with white or yellow spots, feeds on heath. Two other species with white or grey hind wings are found in Scotland, and several others in the Alps and in Northern Europe.

The Small Yellow Underwing (*Heliaca tenebrata*) measures only three-quarters of an inch across the purplish brown fore wings. It is common in meadows, where the green, white-lined caterpillar feeds on mouse-ear chickweed.

The *Acontiidæ* contain a few pretty little species, rarely measuring more than an inch in expanse. We will mention a few.

The Small Purple-barred (*Prothymnia viridaria*, Plate 19, fig. 3) has dark olive-green fore wings, with two purple-red transverse bands in the marginal area. The hind wings are similar, but with a darker band. The caterpillar is green, with light and dark longitudinal lines, and a light brown head. It feeds on low plants. It is common in Europe, including the British Islands.

Erastria deceptoria (Plate 19, fig. 2) has dark olive-brown fore wings with the base, and the space between the posterior transverse line and the subterminal line forming a broad white band, with a dark spot on the costa. The orbicular and reniform stigmata are surrounded with paler, and the transverse lines are dark. The hind wings are grey, with a dark central lunule. The caterpillar is pale green, with two whitish lines on the back and a yellowish one on the side. It feeds on grass. It is found throughout Central Europe except the north-west.

The Spotted Sulphur Moth (*Erotyla trabealis*) is dark brown, with interlacing yellow streaks. It is not a common insect in Britain, and is chiefly met with in the Eastern Counties of England on waste ground, where the caterpillar, which is green or brown with pale lines, feeds on bindweed.

The Four-spot Moth (*Acontia luctuosa*, Plate 19, fig. 1) is not very uncommon in clover fields in the South of England. It is dark brown, speckled with white towards the border, and there is a large white blotch running half across the fore wings, from the front to the middle; and a broad white band across the middle of the hind wings. The caterpillar is grey,

with pale lines and dark spots, and feeds on bindweed and mallow.

The *Plusiidæ* are not very numerous, but include a number of species measuring upwards of an inch and a half in expanse, many of which fly by day, and which are remarkable for the metallic and often letter-like markings on their wings. The moths have long pointed wings, and hover over flowers. Their caterpillars, which are generally green with white or yellow lines, feed on various low plants, and are sometimes destructive.

The commonest of all is the Gamma Moth, or Silver Y Moth (*Plusia gamma*, Plate 19, fig. 10), which is light purplish grey, with a conspicuous white spot shaped like the letter y or γ in the middle of the fore wings. It may be seen flying over flowers in almost any meadow or garden both in the daytime and at dusk, and has been even seen in the snow at the summit of Mont Blanc, whither it was supposed to have been carried up by a current of air. The caterpillar is green with slender white lines along the back, and a yellow line on the sides; it feeds on nettle, rest-harrow and other low plants.

The Golden Y and the Beautiful Golden Y (*Plusia iota* and *pulchrina*) resemble the Gamma Moth, and are often seen in company with it, but the fore wings are more pink, and the metallic spot yellower, and often divided into two. The caterpillars, which are green with white lines and dots, feed on low plants.

Another interesting species is the Burnished Brass Moth (*Plusia chrysitis*, Plate 19, fig. 8), the fore wings of which are varied with brown and brassy green. The caterpillar is pale green with white lines and dots; it feeds on various low plants. It is closely allied to an Indian moth, *Plusia orichalcea*, a name which is sometimes incorrectly applied to the Scarce Burnished Brass Moth (*Plusia chryson*), which is a large species found rarely on the South Coast, and has a large square brassy blotch towards the tip of the fore wings.

Plusia c-aureum (Plate 19, fig. 6) is a Central European species which does not extend its range to the north-west. It has violet-brown fore wings, and is distinguished by a small bright golden C-spot in the middle of the wing, as well as large golden spots on the inner and hind margins, and a small one at the base. The caterpillar is green and humpy, with white stripes on the sides of the anterior segments, and dark green oblique streaks on the remaining segments, thickly edged with white. It feeds on columbine, etc.

The Monkshood Moth (*Plusia moneta*, Plate 19, fig. 7) has pale golden fore wings, whitish on the hind margin, varied with violet-grey; with dark slightly dentated double transverse lines, a dark central shade, and a silvery kidney-shaped orbicular stigma edged with brown. The hind wings are brownish grey, darker at the hind margin. It inhabits hilly districts in Europe, but is sometimes to be met with in English gardens. The caterpillar is light green dotted with white, with a dark green dorsal and white lateral line. It feeds on monkshood.

The Gold-spot (*Plusia festucæ*, Plate 19, fig. 9) has rusty brown fore wings, varied with gold-colour, with two silvery pear-shaped spots in the middle; and a silvery blotch between the posterior transverse and the subterminal lines, which are brown, as is also the central shade. The hind wings are yellowish grey. It has a wide range in Europe. The caterpillar is green, with a dark green line on the back, edged with white, a white and a yellow line on the sides, and yellowish incisions. It feeds on various grasses.

On the Continent we meet with one or two species of *Plusia* with yellow hind wings.

The Dark Spectacle Moth (*Abrostola triplasia*, Plate 19, fig. 5) has dark grey fore wings, with black transverse lines edged with rust-colour; a yellowish dentated subterminal line; dark brown stigmata surrounded with blackish, and a light brown basal area. The hind wings are dark grey, with chequered fringes. The caterpillar is green, with a white lateral line, and oblique white streaks and black spots above it. It feeds on nettle. The moth is common in the British Islands, appearing about June.

The Herald Moth (*Scoliopteryx libatrix*, Plate 19, fig. 4) is a common moth of very peculiar appearance, and quite unmistakable. The fore wings are almost hooked, with the margins strongly and irregularly dentated. The fore wings are reddish brown, blotched with red, and crossed by two white bands; the hind wings are ashy grey. The caterpillar is green, with a white or yellow line on the sides, and feeds on poplars and willows. The moth appears in autumn, and hides itself during the winter under eaves, or bridges, and reappears in early spring; it is not an uncommon species during a great part of the year.

The Mouse (*Amphipyra tragopogonis*) is another moth which is very fond of coming into houses; but unlike the Herald, the wings are moderately long and broad, and obtusely rounded

at the extremity. It is dark brown, dusted with grey, and the hind wings are more yellowish. It measures about an inch and a half across the wings, and the caterpillar, which is green with white lines, feeds on low plants.

The Copper-Underwing (*Amphipyra pyramidea*, Plate 17, fig. 4) is another representative of the family *Amphipyridæ*. It is larger and handsomer than the Mouse; it measures two inches across the fore wings, which are of a lighter brown; and the hind wings are dull red. The caterpillar is green, with white and yellow lines, and a red-tipped hump on the back near the extremity of the body. It feeds on various trees, and is not uncommon, though less abundant than the Mouse.

Amphipyra livida (Plate 17, fig. 3) is a somewhat similar but smaller species, inhabiting Southern Europe and the southern parts of Central Europe, as well as the adjoining parts of Asia. It has deep violet-black fore wings, without markings, and light brownish red hind wings, tinged with dark grey on the margins. The caterpillar is bluish green with a dark green line along the back, edged with white, and a yellowish line on the sides. It feeds on dandelion, and other low plants.

Mecoptera or *Orrhodia fragariæ* (Plate 17, fig. 13) is a handsome but rare moth, which is found in Southern Germany, Austria, and Switzerland. It has brownish grey fore wings, with the central area olive-brown, yellowish grey transverse lines, a thick straight subterminal line bordered with dark brown, and stigmata surrounded with greyish yellow. The hind wings are dark greyish brown, with a blackish lunule and margins. The abdomen has black and yellow rings. The caterpillar, which is velvety reddish brown with a black cervical plate, feeds on grasses, dandelion, sorrel, etc.

The Chestnut Moth (*Orrhodia vaccinii*, Plate 17, fig. 14) is an allied British species, but is smaller and less conspicuous. The fore wings vary from coppery brown to dark grey, with more or less distinct markings. The transverse lines are indistinct, brown and double. The subterminal line is represented by a row of black dots, and the orbicular and reniform stigmata are filled with blackish in their lower parts. The hind wings are dusky grey. The caterpillar is dark cinnamon-brown, with three pale lines on the back, with pale dots between them, and a dark brown cervical plate. It feeds on oak, as well as on low plants, such as bilberry.

The Gothic (*Nænia typica*, Fig. xviii.) has greyish brown

fore wings, with light grey transverse lines edged with darker, a white subterminal line, and white-edged orbicular and reniform stigmata; near the base between the two stigmata, are dark brown spots, as well as in front of the subterminal line. In the male the nervures are dusted with white. The hind wings are greyish brown. Like the next species, it frequents damp places. The caterpillar is brown or greyish ochreous, with reddish grey lines on the sides, and dark oblique streaks above them. It feeds on nettle, etc.

Fig. xviii.—The Gothic (*Nænia typica*).

One of the largest and commonest of our garden moths is the Old Lady (*Mormo* or *Mania maura*, Plate 16, fig. 6), a dark brown moth with irregular lighter and darker lines and blotches; the margins are slightly dentated. It flies about in the evening, and is very fond of coming into houses in the country. The caterpillar is grey, with pale lines and dark spots, and feeds on low plants, and also on willow, etc.

The *Catocalidæ* are a family of large and handsome *Noctuæ*, of which we have only a few representatives in England. The moths are fond of resting on tree trunks and posts in the daytime, and may also be taken at sugar. The largest species, the Clifden Nonpareil (*Catocala fraxini*, Plate 20, fig. 1) is widely distributed in Britain, but is always very scarce; it measures four inches in expanse, and has light grey fore wings, with zig-zag pale and dark lines and blotches; and the hind wings are black, with a broad curved band of pale blue. The caterpillar is grey or light brown, and has fleshy filaments on the sides; it feeds on poplar and various other trees, and loops slightly in walking.

The other British species of *Catocala* are smaller, and have grey fore wings, with zig-zag markings, and the hind wings are red or crimson, with broad black borders and central bands.

The commonest is the Red Underwing (*Catocala nupta*, Plate 20, fig. 3), which measures about three inches across the wings. The caterpillar is brownish grey, with yellow spots and lines, and feeds on poplars and willows, round which the moth may sometimes be seen flying by day.

C. electa (Plate 20, fig. 2) has pale ashy grey fore wings, varied with brownish, and carmine hind wings, with black hind

margins and central band, the latter not reaching to the inner margin. It is a Central European species more particularly met with in the South. The caterpillar is yellowish grey or yellowish brown, finely dotted with black with a yellow hump beyond the middle, and two points near the extremity. It feeds on willow and poplar.

The Dark Crimson Underwing (*C. sponsa*, Plate 20, fig. 4) has bright carmine hind wings, with deep black margins and a black central band shaped like a W. It is rare in England, though fairly common on the Continent. The caterpillar is greyish brown or reddish brown speckled with darker, with a yellowish transverse hump beyond the middle and another hump near the extremity. It feeds on oak.

The Light Crimson Underwing (*C. promissa*, Plate 20, fig. 5) is smaller than the previous species described expanding only from two to two and a quarter inches. It has crimson hind wings, with broad black hind margins and a narrow and only slightly curved black central band. It is local in the South of England and in Central and Southern Europe. The caterpillar is greenish grey, and is very like that of the last species. It also feeds on oak.

There are many other species of *Catocala* on the Continent of Europe, Asia, and North America, some of which have the hind wings banded with yellow instead of red; and we have figured one of them, *C. fulminea* (Plate 21, fig. 1), with its caterpillar, which feeds on sloe and whitethorn. Some of the Asiatic and North American species have entirely black hind wings.

There are two conspicuous moths measuring about an inch and a quarter in expanse which fly in meadows in the daytime like Skipper Butterflies, which they considerably resemble in appearance, except for their slender antennæ. The Mother Shipton (*Euclidia mi*, Plate 19, fig. 11) has dark brown fore wings, with very irregularly curved pale lines; and the hind wings are blackish, with two or three rows of more or less connected pale spots. The caterpillar, which feeds on clover, is brown with yellowish wavy lines. The other moth, the Burnet Companion (*Euclidia glyphica*, Plate 19, fig. 12), has brown fore wings, varied with grey, and the pale lines are much less irregular than in the Mother Shipton. The hind wings are brown, with the outer half pale yellow, divided by an irregular brown band. The caterpillar, which is yellowish brown with a darker dorsal line, feeds on clover, etc.

The Lunar Double Stripe (*Pseudophia lunaris*, Plate 19, fig. 13) is a large and handsome species, common in many parts of Central Europe, but very rare in the British Islands. The prevailing colour of the fore wings is violet-brown, with two light transverse bands, broadly tinged with olive-brown on the inner side, and pale transverse lines. Near the costa is a brown spot. The hind wings are yellow, with a dark band. The caterpillar is grey, with two reddish stripes on the sides, and numerous wavy dark longitudinal lines, as well as two yellow warts on the back of each segment. It feeds on oak and poplar.

The Alchymist (*Catephia alchymista*, Plate 19, fig. 14) is called in Germany the White Underwing. It has blackish fore wings, with deep black dentated transverse lines and a pale brown subterminal line. The hind wings are white, with a deep dark grey border. It is local in Central and Southern Europe, but is extremely rare in England. The grey and brown caterpillar feeds on scrub-oak.

The New Black Neck Moth (*Toxocampa craccæ*, Plate 21, fig. 2) has rosy brownish grey fore wings, with pale nervures, indistinct transverse lines, and no subterminal line; the stigmata are brown, the orbicular being reduced to a dot; on the costa are three or four brown marks. The hind wings are light grey. It is local in Central Europe, and rare in England. The caterpillar is brownish ochreous with a thick dark brown line along the back, and a whitish spot on the last segment. It feeds on vetches.

The Orange Underwings belonging to the family *Brephidæ*, *Brephos parthenias* (Plate 21, fig. 13), and *B. notha* are very similar to the Burnet Companion, but the fore wings are more varied with grey, and the hind wings more brightly coloured. They fly by day in spring about birch and aspen, on which the green caterpillars feed.

The *Deltoidæ* are a small family of rather dull-coloured *Noctuæ*, with broad wings and comparatively slender bodies. Some of the species are remarkable for their prominent palpi, and others for the peculiar tufts of hair on the legs of the males.

The commonest is the Snout (*Hypena proboscidalis*, Plate 21, fig. 6), which has brown and rather pointed fore wings measuring about an inch and a half across; the hind wings are rather paler. The palpi are very long, and project in a straight beak. It swarms in every nettle-bed, among which its caterpillar, which is green with a yellow line on the sides, may also be found.

The Buttoned Snout (*H. rostralis*, Plate 21, fig. 7) is somewhat smaller than the Snout, with rusty brown fore wings, varied with grey, with a fine blackish transverse line edged with lighter; a finely dentated subterminal line; and black orbicular and reniform stigmata connected by a black longitudinal streak. The hind wings are brownish grey. It is found in the same localities as the last species, but is not so abundant. The caterpillar resembles that of the last species but has two white lines on the sides. It feeds on nettle, etc.

The Beautiful Snout (*Bomolocha fontis*, Fig. xix) has the fore wings dark olive-brown, with the hind margin and inner margin broadly greyish white, varied with light brown. The dark colour is sharply bounded from the light. At the apex there is a dark brown spot in the pale area and there is a row of dark submarginal dots edged with white. The hind wings are light brownish grey, with an interrupted dark marginal line. It is common in Central and Northern Europe, but is local in the British Islands. The caterpillar is green, with yellow incisions, three indistinct dark green lines on the back, and four white tubercles on each segment. It feeds on bilberry.

Fig. xix. — Beautiful Snout (*Bomolocha fontis*).

The Beautiful Hook-Tip (*Laspeyria flexula*, Plate 21, fig. 3) is a fairly common species in England and on the Continent. The fore wings are reddish ashy grey, finely powdered with black, with two light transverse lines shaded on both sides with bluish grey; faint pale subterminal line; two black dots in the position of the reniform; and at the apex a violet spot containing a black nucleus with a reddish brown shade beneath it. The hind wings are yellowish grey. The caterpillar feeds on lichens growing on pines and similar trees, and its chequered green and black colouring makes it difficult to distinguish.

Zanclognatha tarsicrinalis (Plate 21, fig. 4) is widely distributed in Central Europe, but does not occur in the British Islands. It has yellowish grey fore wings dusted with brown, with brown transverse and submarginal lines, the latter being almost straight, and a brown reniform stigma. The hind wings are pale grey, with one or two brown lines. The caterpillar is ochre-yellow with black oblique lines and black warts. It feeds on bramble, raspberry, etc.

Herminia tentacularia (Plate 21, fig. 5) has pale yellow fore wings, dusted with brown, with two rusty brown transverse

lines; an almost straight subterminal line; and a small indistinct reniform stigma. The hind wings are somewhat paler, with two rusty brown transverse lines. It is common in Central Europe, but its range does not extend as far as the British Islands. The caterpillar is pale brownish grey finely dotted with white, with a dark brown dorsal line and stiff greyish white hairs. It feeds on grasses and low plants.

The family *Cymatophoridæ* consists of moths of moderate size, with tapering abdomens extending beyond the anal angle of the hind wings. The thorax is woolly. The fore wings are elongated with triangular apices, and the hind wings can be folded. The caterpillars are smooth with sixteen legs, and when resting sit on a leaf with the body arched. They form the chrysalis in a loosely woven cocoon. The moths fly late at night, and when at rest keep the wings on the slope.

The Buff Arches (*Habrosyne derasa*, Plate 21, fig. 8) has brownish grey wings tinged with violet, with the central area and a spot at the hinder angle rusty ochreous. The anterior transverse line is broad and white, and is bordered externally by rusty ochreous; whilst the posterior is pale, edged on both sides with black. The subterminal line is thick, white, and nearly straight, and is bordered with brownish externally. On the costa is a white longitudinal mark, interrupted with brown. The hind wings are yellowish grey. It is common in many parts of Central Europe. The caterpillar is reddish brown, with darker spots on the back, intersected by a still darker dorsal line; on the sides of some of the segments are black rings with a white centre. It feeds in the autumn on raspberry and bramble, and the moth appears in June and July.

The Peach-blossom Moth (*Thyatira batis*, Plate 21, fig. 9) is a brightly-coloured insect, with dark greenish brown fore wings, with five large oval, pinkish spots, each with a dark centre. The hind wings are brownish grey. It is not uncommon in the British Islands and in Europe and Asia generally. The caterpillar is brown with rust-coloured markings; there is a bifid hump behind the head, as well as an elevation in the middle of the body and at the extremity. It feeds on bramble and raspberry.

The Poplar Lutestring (*Cymatophora or*, Plate 21, fig. 10) has brownish grey fore wings with four black transverse lines, bounding two dark bands, and greyish white stigmata, the reniform having a dark nucleus; the subterminal line is pale, bounded externally by black wedge-shaped spots. The apex

is intersected by a black streak. The hind wings are brownish grey. It is common in Central Europe, including the British Islands. The caterpillar is pale green with a fine dark line along the back and a whitish line on the sides; it feeds on poplar.

The Figure of Eighty (*C. octogesima,* Plate 21, fig. 11) is distinguished from the last species by the lighter and more reddish tinge of the fore wings and the lighter colour of the hind wings, which have also a pale transverse band. Moreover, the stigmata are larger, paler, and more distinct. It is equally common on the Continent, but is more local in England. The caterpillar is yellowish or brownish white, with paler dorsal and lateral lines; it feeds on poplar.

The Yellow-horned Moth (*Polyploca flavicornis*, Plate 21, fig. 12) is a common species, with grey fore wings whitish along the costa from the base to the middle, black transverse lines and a light submarginal line. The stigmata are greenish white. The caterpillar is greenish grey, with a brownish head and a pale dorsal line and whitish dots; on each segment there are two large black spots with white between. It feeds on birch and poplar.

THE GEOMETRÆ, LOOPERS, OR LAND-MEASURERS

This is a section of moths, rather less numerous than the *Noctuæ*, the greater number of which have rather broad wings and slender bodies, though some species have stouter bodies, and, in a few cases, apterous females. The wings are often brightly coloured, and the pattern of the fore wings is sometimes reproduced on the hind wings, but in other cases the hind wings are plainly coloured. Occasionally the antennæ are more or less pectinated in the males; in other cases the antennæ are simple in both sexes. But the most important character of these moths and that from which they derive their name lies in the structure of the caterpillars, in which one or two of the front pairs of abdominal legs are more or less undeveloped. In this case the caterpillar progresses by fixing itself by its hind legs to a branch or other support, stretches itself out to its full extent, fixes itself by its thoracic legs, draws the back of its body up to the front by arching its back, and repeats the process. This manœuvre is difficult to describe, but is not to be mistaken when observed in life; and such a caterpillar will walk much more quickly than one might be inclined to expect. Often, however, a Looper

caterpillar will fix itself by its hind legs and stretch its body upwards, and remain motionless in this position sometimes for hours, looking for all the world like a small twig.

These moths are generally more brightly coloured and much less retiring than the *Noctuæ*. Some fly by day and others rest on trees and walls, or fly over flowers and bushes, or along hedges in the evening, while many species are easily dislodged in the daytime by shaking or beating bushes. Several genera include a considerable number of allied and sometimes very similar species, especially among those popularly known as Waves, Carpets, and Pugs.

Many of the larger species are common, flying about hedges and bushes, in woods and gardens, in the evening. One of these is the Swallow-tail Moth (*Urapteryx* or *Ourapteryx sambucariæ*, Plate 24, fig. 8) (for there is a Swallow-tail Moth as well as a Swallow-tail Butterfly), a pale primrose-coloured moth, two inches in expanse, with two dark lines on the fore wings and one on the hind wings, and a short angular projection in the middle of the hind wings. The caterpillar, which is very stick-like, feeds on various trees.

We have also a Brimstone Moth (*Rumia cratægata* or *Opisthograptis luteolata*, Plate 24, fig. 9) as well as a Brimstone Butterfly. The wings are an inch and a half in expanse, moderately broad, bright yellow, with some red blotches. It is common on hedges, where its brown or green caterpillar feeds on hawthorn, etc.

Another moth resembling this is the Speckled Yellow (*Venilia macularia*, Plate 24, fig. 10), which is not rare in open places in woods. It is of a deeper yellow than the Brimstone Moth, with many pale brown spots on both the fore and hind wings. The caterpillar, which is green with a dark dorsal line and white lateral lines, feeds on nettle, etc.

The Scalloped Oak (*Crocallis elinguaria*) is a larger and stouter moth, of a pale straw-colour, with a broad darker band on the fore wings, in the middle of which stands a black spot. The brown caterpillar feeds on various bushes, and will also eat other caterpillars.

The moths known as Thorns, belonging to the genus *Ennomos*, etc., expand from an inch and a half to two inches across the wings. They have rather stout, fluffy bodies and yellowish or brown wings, which are more or less angulated and dentated. Several of the species exhibit the phenomenon known as "seasonal dimorphism"; they are double-brooded and the spring and autumn broods exhibit such differences

that for a long time the moths were supposed to represent really different species.

The August Thorn (*Ennomos quercinaria*, Plate 24, fig. 3) has pale ochre-yellow wings; the fore wings have two brown transverse lines, the posterior being continued across the hind wings. The caterpillar is reddish brown, with humps on three of the segments. It feeds on oak, beech, birch, and lime.

The Early Thorn (*Selenia bilunaria*, Plate 24, fig. 4) has light ochre-yellow wings in the male, finely dusted with brown; and olive-brown wings in the female. The fore wings are whitish on the costa, with an indistinct central lunule, two dark transverse lines expanding at the costa, and a grey central shade, which is continued on the hind wings. The caterpillar is stout, grey or brown, like the bark of a tree, with double humps on two of the segments.

The Scalloped Hazel (*Gonodontis bidentata*, Fig. xx.) has greyish or yellowish brown fore wings, with two dark brown transverse lines, edged with white, which bound the central area. The hind wings are paler, with a dark transverse line. All the wings have a dark brown central spot with a light nucleus. It is common in the British Islands and on the Continent. The caterpillar is grey or brown, with irregular dark spots. It feeds on poplar, sloe, oak, alder, etc.

Fig. xx.—Scalloped Hazel (*Gonodontis bidentata*).

The Barred Red (*Ellopia prosapiaria*, Fig. xxi.) has flesh-coloured fore wings, darker in the central area, with two parallel whitish transverse lines, shaded with brown, the posterior being continued on the hind wings. It is common in pine woods in Northern and Central Europe. The caterpillar is reddish brown, varied with whitish, with dark triangular spots on the back. It feeds on fir and pine.

Fig. xxi.—Barred Red (*Ellopia prosapiaria*).

The Lilac Beauty (*Pericallia* or *Hygrochroa syringaria*, Plate 24, fig. 5) has pale olive-brown wings, varied with rusty ochreous. The fore wings have three large pink spots on the costa, and indistinct pink transverse stripes, which

are continued on the hind wings. From the tip of the fore wings to the inner margin of the hind wings runs an oblique rusty brown line. The caterpillar is stout, brownish, varied with yellow, sometimes rosy red on the back, with short double points on two of the segments, and two long fleshy filaments on another. It feeds on lilac, bird-cherry, and elder.

The Orange Moth (*Angerona prunaria*, Plate 24, fig. 7) is a very variable species. The wings are orange-coloured in the male and ochre-yellow in the female, covered with innumerable fine dark transverse streaks. The caterpillar, which is attenuated in front, is brownish grey, with pointed humps on one of the segments and shorter ones on three of the others. It feeds on sloe, hazel, whitethorn, etc.

The Light Emerald Moth (*Metrocampa margaritata*, Plate 24, fig. 2) has pale green wings; the fore wings have two white transverse stripes shaded with dusky, the posterior being continued across the hind wings. The caterpillar is brownish grey, with blackish dorsal and lateral lines, and with a pale tubercle on the sides of each segment. It feeds on oak and beech.

The Feathered Thorn (*Himera pennaria*, Plate 24, fig. 6) has light reddish brown fore wings, with two dark brown transverse lines, a brown central spot, and a white spot near the tip, edged with black. The hind wings are lighter, with a double dark line. The larva is greyish brown, with dark brown markings on the sides, causing it to resemble bark; or it may be grey with yellow longitudinal lines and marks. It has two pointed projections near the extremity. It feeds on oak, willow, birch, and fruit trees.

The Pepper and Salt Moth (*Amphidasis betularia*, Plate 25, fig. 2) represents a small group of *Geometræ* with stout hairy bodies, rounded wings, grey or brown in colour, and with strongly pectinated antennæ in the males. Most of the species may be found resting on tree-trunks in early spring; and several of the females are apterous. The Pepper and Salt Moth, however, appears in early summer. It measures two inches across the wings, which are white, speckled with black. The sexes are nearly similar, except that the male has pectinated antennæ; but there is a very dark, almost black, variety, which is rare near London, but common in the North of England. The caterpillar, which is very variable in colour, with a hump beyond the middle and another at the extremity, feeds on trees.

The Oak Beauty (*Biston stratarius*, Plate 25, fig. 1) has

greenish white fore wings, sprinkled with black, with two strongly dentated black transverse lines enclosing a pale central area. The hind wings are paler, dusted with dark brown, with a broad dark transverse band. The caterpillar is rusty brown or ashy grey, with small tubercles and lateral projections on several segments. It feeds on various trees, especially on poplar and lime.

The Pale Brindled Beauty (*Phigalia pedaria*, Plate 24, fig. 14) has broad greenish grey fore wings in the male, dusted with darker, with suffused dark transverse lines. The hind wings are paler and more thinly sprinkled. The female has very short stumps of wings, smoothy scaled; the head and thorax are pale grey, and the abdomen reddish brown, with the first segment darker. The caterpillar is greenish or ochreous brown, with black streaks and yellow spots. It feeds on sloe.

Another dull-coloured group of *Geometræ* is represented by *Boarmia* and allied genera. They are grey or brown, with rounded and sometimes slightly dentated wings. They measure from an inch and a half to two inches across the wings; and one or two species, such as the Mottled Beauty and the Willow Beauty (*Boarmia rhomboidaria*), are common in gardens.

The Mottled Beauty (*Boarmia repandata*, Fig. xxii.) has pale grey fore wings, marbled with yellowish and brown, with two blackish transverse lines, a faint central shade, and a whitish zig-zag subterminal line. The hind wings are lighter, with a dark transverse line and a pale subterminal one. The caterpillar is grey, darker on the back, with light grey dorsal and lateral lines. It feeds on willow, birch, broom, bramble, bilberry, etc.

Fig xxii.—Mottled Beauty (*Boarmia repandata*).

The Ringed Carpet (*Boarmia cinctaria*, Plate 25, fig. 3) has pale grey fore wings, dusted with brown, with a whitish central spot bounded by black transverse lines, and a whitish dentated subterminal line. The hind wings are of the same colour as the fore wings, with the posterior transverse line, and the subterminal line continued upon them. It is local in the British Islands, though common on the Continent of Europe. The caterpillar is green, with a dark green line along the back and several white lines on the sides; the posterior edge of each segment is

yellowish. It feeds on sloe, wormwood, St. John's wort, broom, and other low plants.

The Pale Oak Beauty (*Boarmia consortaria*, Plate 25, fig. 4) has ashy grey wings dusted with dark brown, with a black dentated posterior transverse line and a faint brown anterior one. The subterminal line is lgiht shaded with darker, and there is a dark central dot on each of the wings. It is rather local in England. The caterpillar is grey, with brown spots and tubercles and a dark dorsal line. It feeds on oak, sloe, willow, apple, and other trees.

The Brussels Lace (*Baormia lichenaria*, Plate 25, fig. 5) has light grey wings, varied with moss-green and dusted with brown. The fore wings have two dark brown transverse lines, bordered with whitish, enclosing a dark central area, the posterior being much dentated; and a small black central dot. The hind wings are paler, with one transverse line. The caterpillar is humped, green varied with white, with brown dots. It feeds on lichens growing on trees, and its colouring is an instance of protective resemblance.

The Dark Annulet (*Gnophos obscurata* or *obscuraria*, Plate 25, fig. 6) is an allied species which is found in many parts of the British Islands and is common in Central and Southern Europe. It has violet-grey wings finely dusted with darker, with blackish central lunules and dentated hind margins, especially on the hind wings. The fore wings, which have acute tips, have two dark dentated transverse lines, and an indistinct whitish subterminal line. The caterpillar is light or dark reddish grey, with yellowish dorsal lines, and with oblique yellowish marks on the sides of the middle segments, bordered in front with darker. It feeds on low plants.

The *Fidoniidæ* are a group of rather small moths mostly found on heaths in the daytime. They are grey, brown, or yellowish, with darker and frequently somewhat reticulated markings.

One of the largest species is the Bordered White (*Fidonia* or *Bupalus piniaria*, Plate 25, fig. 8), which is common flying round fir trees in the daytime, and is interesting on account of the difference in the sexes. It measures nearly an inch and a half in expanse; the male is of a more or less yellowish-white, broadly bordered and varied with brown, and the female is yellow, sometimes varied with brown. The caterpillar, which is green with three white dorsal lines and a yellow lateral line, feeds on fir.

The Common Heath Moth (*Fidonia* or *Ematurga atomaria*, Plate 25, fig. 7) has the wings ochre-yellow in the male, whitish in the female, sprinkled with brown. There are three brown transverse lines on the fore wings and two on the hind wings. The caterpillar is yellowish brown, and feeds on heath, broom, etc.

The Purple-banded Wave (*Lythria purpuraria*, Plate 22, fig. 16) has greenish ochreous, or sometimes dark olive-green fore wings, with two reddish purple transverse bands; the hind wings are ochre-yellow. It is common throughout the Continent of Europe, but is a rarity in England.

The moths known as Emeralds, belonging to the genus *Geometra* and its allies, are common in woods and about hedges and banks. They are remarkable for the bright green colour of most of the species, and the caterpillars mostly live on various trees.

The Grass Emerald (*Pseudoterpna pruinata*, Plate 22, fig. 1) has pale green wings dusted with white; the fore wings with a dark central area, two dark dentated transverse lines, and a white submarginal line, which is continued on the hind wings. It is common throughout Central and Southern Europe. The caterpillar, which is green with a dark dorsal line, and whitish lateral line bordered below with reddish, feeds on broom, etc.

The Large Emerald (*Geometra papilionaria*, Plate 22, fig. 2) expands about two inches. It has bright green wings, each with a dark green central lunule and a row of whitish crescents in the marginal area. The fore wings have two dentated transverse lines, and the hind wings one. It is widely distributed in Europe, but is not abundant. The caterpillar, which is green with a yellowish lateral line, and small warts, feeds on birch, alder, beech and hazel.

The Essex Emerald (*Euchloris smaragdaria*, Plate 22, fig. 3) has green wings, the fore wings narrowly brownish white on the costa, with two white dentated transverse lines and a white central lunule; the hind wings are paler towards the base, with a fine white curved line in front of the hind margin. It is widely distributed in Europe, but in England is only found on the coast of Essex. The caterpillar is greyish brown with black warts, a black dorsal line and a pale lateral line. It feeds on yarrow.

The Small Grass Emerald (*Nemoria viridata*, Plate 22, fig. 4) has dingy yellowish green wings, with white fringes; the fore wings with two white slightly waved transverse lines, the posterior being continued on the hind wings. It is common in the greater part of Europe, but is local in England. The

caterpillar is green, marked with reddish brown, and feeds on heath and whitethorn.

Perhaps the commonest of all our British *Geometræ* is the well-known Magpie Moth (*Abraxas grossulariata*, Plate 23, fig. 15), which is found in every garden. It expands an inch and a half or upwards, and is white, with numerous black and orange spots, varying considerably in different specimens. It often flies in the daytime, or may be seen sitting on leaves or walls. The caterpillar is white spotted with black, and marked with a yellow line on each side. It feeds on gooseberry, currant, sloe, etc.

The Clouded Border (*A. marginata*, Plate 23, fig. 16) has cream-coloured wings, with a broad blackish brown marginal band with a wavy outline. The fore wings have two large elongated blackish brown spots on the costa, one of which is sometimes connected with the blackish central spot. The hind wings have a black central dot. The caterpillar is dark green, with three slender dark lines on the back and a whitish stripe on the sides. It feeds on poplar, willow, hazel, etc.

The Barred Umber (*Numeria pulveraria*, Plate 24, fig. 1) has light brown fore wings, dusted with rusty brown, with an olive-brown central area bounded by faint brown transverse lines. The hind wings are somewhat lighter. The caterpillar is brown, with two dark brown waved lines on each side. It feeds on willow, birch, and oak.

The Bordered Grey (*Selidosema plumaria*, Fig. xxiii.) has bluish grey wings with broad violet-brown hind margins. On the fore wings are a suffused dark brown submarginal line, three dark costal spots, and a black central lunule. The female is smaller and paler, with a stouter body. It is local on heaths in this country and on the Continent. The caterpillar is reddish brown, with black dorsal spots and lateral streaks. It feeds on heath, broom, etc.

Fig. xxiii. — Bordered Grey (*Selidosema plumaria*).

The Small Peacock Moth (*Macaria* or *Semiothisa notata*, Plate 24, fig. 11) has cream-coloured wings, dusted with grey. The fore wings are slightly indented below the tip, and have three faint grey transverse lines, and several large and small yellowish brown spots on the costa. The hind wings have a short tail, a black central dot, and two faint grey transverse lines. The caterpillar is green

or brownish, with reddish brown dorsal spots and a reddish brown lateral line. It feeds on willow, birch, etc.

The Latticed Heath (*Phasiane clathrata*, Plate 25, fig. 10) has white wings tinged with yellow; the fore wings with four and the hind wings with three, dark brown transverse lines, partially united. The nervures are dark brown, and the fringes are chequered. The caterpillar is bluish green, with a fine dark dorsal line and a broad white stripe on the sides, edged with darker. It feeds on clover.

The Black-veined Moth (*Scoria lineata*, Plate 25, fig. 11) has greenish white wings, with the nervures sprinkled with brown on the under side, showing through on the upper. The caterpillar is yellowish grey, with a dark brown dorsal line edged with yellowish, and a yellowish lateral stripe. It feeds on broom, dead nettle, and various other low plants.

There are a considerable number of rather small moths belonging to the families *Caberidæ* and *Idæidæ*, known as Waves. The greater number measure an inch or less across the fore wings, which are moderately broad, and either rounded or slightly pointed at the tips, and are white, yellow, or brown, with darker waved lines. Most of the caterpillars generally feed on low plants.

The White Wave (*Cabera pusaria*) measures about an inch and a quarter across the rounded wings, which are white, with three brown lines. The green, red-spotted caterpillar feeds on birch and alder.

Another species, the Common Wave (*Cabera exanthemata*), which is equally common, especially in damp woods, much resembles this, but is more yellowish white. The caterpillar, which is brown or green with yellow lines and spots, feeds on hazel and alder.

One of the most conspicuous of the Waves is the Blood-vein (*Timandra amataria* or *amata*, Plate 22, fig. 15), which is common in weedy places, where it may be found at rest in the daytime. It measures an inch and a quarter across the wings; the fore wings are rather pointed, and the hind wings angulated in the middle. The colour is yellowish grey, with a dull red stripe running obliquely from the tip of the fore wings to the middle of the inner margin of the hind wings. The caterpillar is greyish brown, with white lines, and feeds on dock, etc.

A somewhat similar Continental species is *Rhodostrophia vibicaria* (Plate 22, fig. 14), which is common in dry sunny places. It has greenish grey wings, with three fine rosy red

transverse lines, the two outer ones enclosing a broad reddish violet band. The fringes are rose-coloured. The caterpillar is yellowish, with a pale dorsal line edged with brown. It feeds on sloe, broom, etc.

The V-Moth (*Thamnonoma vauaria* or *wauaria*, Plate 25, fig. 9) has pale olive-grey fore wings, with four dark rusty brown spots on the costa, the second of which is directed outwards and forms a V-shaped transverse line. The hind wings are pale ashy grey, dusted with blackish. It is common about garden walls. The caterpillar is bluish green or violet-brown, with a dark dorsal line bordered with white, and a yellow lateral one. It feeds on gooseberry, raspberry, etc., and often causes a good deal of damage to the plants.

Idæa or *Acidalia trilineata* (Plate 22, fig. 5) has golden yellow wings, with yellowish grey fringes ; the fore wings with three dark grey slightly waved transverse lines on the fore wings, and two on the hind wings. It occurs in Southern and Eastern Europe. The caterpillar, which is reddish ashy grey with a white dorsal line bordered with black, feeds on dock and other low plants.

Idæa or *Acidalia similata* (Plate 22, fig. 6) has dull ochre-yellow wings, with slightly waved brown transverse lines, and brown fringes. It is widely distributed in Europe. The caterpillar, which is greyish brown with three rows of longitudinal lines, feeds on low plants.

The Purple-bordered Gold (*Idæa* or *Acidalia muricata*, Plate 22, fig. 7) has golden yellow wings, thickly dusted with reddish purple, except at the lower part of the base, and two oval spots on the fore wings and one on the hind wings. There is a dark red line in front of the hind margin of the fore wings. It is widely distributed in Europe, but is local in the British Islands. The caterpillar is cinnamon-colour, with two dark grey lines on the back, as well as square black spots on the middle segments. It feeds on plantain, lettuce, etc.

The Treble Brown-spot Wave (*Idæa* or *Acidalia bisetata*, Plate 22, fig. 8) has straw-coloured wings, with a brownish grey band in the marginal area, intersected by a faint light zig-zag submarginal line ; and a black central dot. It is a common British species, and is widely distributed in Central Europe. The caterpillar is clay-coloured without markings, but with four pointed tubercles on each segment. It feeds on low plants,

The Riband Wave (*Idæa* or *Acidalia aversata*, Plate 22, fig. 9) is one of the commonest of the waves. The wings are straw-coloured in the male and brownish yellow in the female, finely

with black, with an interrupted black marginal line, a black central dot, and a dark grey transverse band. The caterpillar is brown and yellowish grey with dark lozenge-shaped spots on the middle segments. It feeds on dried leaves.

The Cream Wave (*Idæa* or *Acidalia remutaria*, Plate 22, fig. 10) has pale straw-coloured wings, finely dusted with brown, with three brownish grey transverse lines, sometimes faint. It is common in most parts of Central and Northern Europe. The caterpillar is yellowish grey with indistinct lozenge-shaped spots on the back and a whitish line on the sides. It feeds on plantain, woodruff, etc.

The Lace Border (*Idæa* or *Acidalia ornata*, Plate 22, fig. 11) has white wings with a dark interrupted transverse line, beyond which in the marginal area, is a band which is broken up into brownish spots. Each wing has a dark central dot, but that on the fore wings is indistinct. It is common in many parts of Central and Southern Europe, but is local in the South of England. The caterpillar is grey, with a reddish dark-bordered dorsal line, and fine dark lateral lines. It feeds on thyme, yarrow, etc.

The Mocha (*Ephyra annulata*, Plate 22, fig. 12) has straw-coloured wings, with two dark brown dentated transverse lines, a large dark brown central ring, a black dotted marginal line, and a narrow curved line near the base. The caterpillar is velvety green with three yellow lines on the back, and a whitish stripe on the sides. It feeds on maple and birch. It is a common species, as is also the Maiden's Blush (*Ephyra punctaria*, Plate 22, fig. 13). This has ochre-yellow wings, dusted with blackish and reddish, with a brown median stripe, two dotted transverse lines, and an interrupted black marginal line, but no central rings. The hind wings are paler than the fore wings. The caterpillar is green or brown with a dark dorsal line on the sides, interrupted by rusty red spots. It feeds on oak and birch.

There are a few moths of a brown or grey colour, with rather broad slender wings, about an inch and a half in expanse, which are known as Winter Moths because they are found on tree trunks and hedges only in very early spring and very late autumn. The caterpillars feed on various trees, and are sometimes very injurious, especially to fruit-trees. They form their chrysalides in the ground at the foot of trees, and the females, most of which are apterous, creep up the trunk to lay their eggs; and it is to prevent this that the trunks of trees are sometimes protected by bands of straw, or belts of lime in orchards.

The Spring Usher (*Hibernia leucophæaria*, Plate 24, fig. 12) is an early spring moth, appearing in February and March. The fore wings are grey in the male, dusted with brownish grey and varied with whitish, with two blackish transverse lines; the hind wings are dusted with pale grey. The female is pale grey, with very short stumps of wings with hair-like fringes, and two dark transverse lines. The caterpillar is reddish or dingy green, with two dark dots on each segment, two whitish dorsal, and two brown lateral lines. It feeds on oak and aspen.

The Dotted Border (*H. marginaria*, Plate 24, fig. 13) has reddish ochreous fore wings in the male, varied with brown and dusted with black, with two slightly curved dark brown transverse lines and black marginal dots. The hind wings are whitish, with black marginal dots also. The female has the fore wings two-thirds as long as the body, and the hind wings three-quarters as long. The fore wings have two black transverse lines, and the hind wings three. The caterpillar is brownish ochreous, with a brown dorsal line on the anterior segments, and brown X-shaped marks on the posterior ones. It feeds on oak, birch, poplar, and wild rose.

The Early Tooth-striped Moth (*Lobophora carpinata*, Plate 23, fig. 2) has pale grey fore wings, with indistinct double brownish transverse lines, forming dark spots on the costa. The hind wings are greyish white, with a dark marginal line. The caterpillar is dark green with a double pale yellow line on the back, and feeds on willow and poplar.

The Winter Moth (*Cheimatobia brumata*, Plate 23, fig. 3) is common from October to December. The male has yellowish grey fore wings, with faint dark wavy lines; and lighter hind wings. All the wings have dark marginal dots. The female has brownish grey stumps of wings, which are about one-fourth of the length of the body, marked with one or two dark transverse bands. The male may be found in the winter in orchards or flying about hedges, or the borders of woods. The female lays its eggs on twigs, where they remain through the winter. As the females are unable to fly, the fruit trees can be protected by encircling the stems with sticky substances, in which the insects become entangled. The caterpillar is yellowish green, with a dark dorsal line and three white lateral lines. The young caterpillar emerges from the egg in March or the beginning of April, and is mature by May. It feeds on various fruit trees, especially apple and cherry, living in a web.

Most of the smallest species of *Geometræ* belong to the extensive genus *Eupithecia*, and are popularly known as "Pugs." Few of them measure as much as an inch in expanse, and the wings are generally longer than broad, and more or less rounded at the extremity. They are generally brown, or yellowish brown, with a black spot in the middle of each wing, or with darker lines and spots. Some species are more conspicuously coloured; thus the Nettled Pug (*Eupithecia venosata*) is brownish grey, with interlacing black lines; the grey caterpillar feeds on the seeds of campion and catchfly, and the moth flies over these plants in the evening.

The Lime-speck Pug (*Eupithecia centaureata*) is a small whitish moth, with a large square blotch near the front of each fore wing; the slender green or pink caterpillar feeds on groundsel and other low plants.

The Narrow-winged Pug (*Eupithecia nanata*) has longer and narrower wings than most of its allies. It is grey, with whitish and dark lines, and a conspicuous black and white spot in the middle of the fore wings. The green caterpillar feeds on heather, and the moth is common on heaths in the daytime.

One or two small species are green in colour, one of which, the Green Pug (*Eupithecia* or *Chloroclystis rectangulata*, Plate 23, fig. 13), is green, with darker lines and markings, and is sometimes destructive in orchards, where its caterpillar, which is green with a red dorsal and a yellowish lateral line, feeds on apple and pear blossoms.

Another, the Shaded Pug (*Eupithecia* or *Tephroclystia scabiosata*, Plate 23, fig. 12) measures only three-quarters to one inch in expanse of wings. It has whitish fore wings, dark grey in the marginal area and on the costa, with yellowish nervures and dark grey transverse lines. The hind wings are white, with grey waved lines. There is a dark central dot on all the wings. The green and red caterpillar feeds on a variety of low plants.

A number of moderate-sized *Geometræ* are known as Carpets, owing to the festooned markings on the fore wings. The hind wings are generally plainly coloured; brown or grey. Many species are common everywhere about hedges and bushes, such as the Garden Carpet (*Melanippe fluctuata*), which has grey fore wings broadly banded with brown; it measures about an inch in expanse. The grey caterpillar feeds on cruciferous plants.

Another common species in weedy places is the Silver Ground Carpet (*Melanippe montanata*), which is rather larger

than the Garden Carpet, and is greyish white, with a broad brown band across the fore wings. The grey caterpillar feeds on low plants.

The Argent and Sable (*Melanippe* or *Larentia hastata*, Plate 23, fig. 9) has black wings with a broad white band through the middle and narrower white bands and spots. The dark brown caterpillar has a black dorsal line edged with yellow, and yellow lateral lines and spots. It feeds on birch.

Commoner still is the Yellow Shell (*Camptogramma* or *Larentia bilineata*, Plate 23, fig. 10), a yellow moth with waved brown lines, which may be beaten out of almost any bush in summer. It measures about an inch in expanse. The caterpillar, which is green with dark green and white lines, feeds on grass, sorrel, dandelion, etc.

The Barred Straw (*Cidaria* or *Larentia dotata*, Plate 23, fig. 5) has pale yellow fore wings, with two or three brown transverse lines, angulated above the middle, and sometimes a row of pale submarginal spots. The hind wings are paler. The caterpillar is greenish with a dark line along the back and a pale one on the sides; it feeds on bedstraw, woodruff, etc.

The Purple Bar Carpet (*Melanthia* or *Larentia ocellata*, Plate 23, fig. 6) has cream-coloured fore wings, with the basal and marginal areas dark, the latter containing two black spots. In the marginal area there is a row of pale spots and two black wedge-shaped spots. The hind wings are cream-coloured, with a dark margin and central dot. The caterpillar is brown with white angular markings edged with black, and with a black line on the side. It feeds on bedstraw.

The Juniper Carpet (*Thera* or *Larentia juniperata*, Plate 23, fig. 7) has ashy grey fore wings, with the base and central area brownish, the latter being bounded by dark transverse lines, the posterior of which is angulated above. The hind wings are grey, with an indistinct transverse band. The caterpillar, which feeds on juniper, is green with a dark line on the back, bordered with white, and yellow lines on the sides, edged with brown.

The Green Carpet (*Larentia viridaria*, Plate 23, fig. 8) has green fore wings, with three white transverse lines partially bordered with brown, the outermost being deeply dentated. On the costa are two angular spots, and there is another on the middle of the inner margin, as well as one near the tip. The subterminal line is white, and is generally broken up into spots. The hind wings are grey, darker towards the margins,

with a faint transverse band. The central spots are brown, and are sometimes very faint. The caterpillar is dingy brown, with a pale line along the back, darker posteriorly, and a waved whitish line along the sides. It feeds on sorrel and dead nettle.

The Barberry Carpet (*Anticlea* or *Larentia berberata*, Plate 23, fig. 11) has violet-grey fore wings, with dark brown transverse bands, one in the basal area and another between the basal and central areas; beyond this is a dark brown zig-zag line. The hind wings are pale brownish grey. The caterpillar is warty, yellowish brown and grey, with an indistinct darker line along the back, edged with white, and a blackish line on the sides. It feeds on barberry.

The Tissue Moth (*Triphosa dubitata*, Plate 23, fig. 4) has shining brownish grey fore wings varied with rose-colour, with the central area darker; with dark dentated transverse lines, a whitish subterminal line, expanding into a white spot at the hinder angle; and a fine black marginal line. The hind wings are light grey, darker at the hind margin. The caterpillar is pale green, with four pale yellow dorsal lines and a yellow lateral stripe. It feeds on sloe, whitethorn, etc.

The Small Waved Umber (*Phibalapteryx vitalbata*, Plate 23, fig. 14) has light brown fore wings, with the costa broadly cream-coloured, and with numerous transverse lines which are dark brown in the central area and rusty-brown in the basal and marginal areas. The subterminal line is whitish, and encloses some dark grey spots in its upper portion. The tip is divided by a black streak. The hind wings are pale brownish grey, with darker and lighter lines. It is widely distributed in Europe and Asia, but is a local insect in England. The caterpillar is bluish green, or brownish with a darker line along the back, which expands into oval spots on the middle segments, and a yellowish line on the sides. It feeds on traveller's joy.

Larger and handsomer species are the Mallow Moths and the Treble Bar, which measure about an inch and a half across the wings. The Mallow Moth (*Eubolia* or *Ortholitha cervinata*, Plate 22, fig. 17) has fawn-coloured fore wings, with three whitish transverse lines, the space between the innermost and the base, and that between the two outer lines, being dark brown. There is a white uniformly dentated subterminal line, and there are several light brown waved lines near the hind margin. The hind wings are brownish grey, darker marginally. The caterpillar is green,

finely pubescent, whitish in the incisions and beneath, with indistinct dark longitudinal lines. It feeds on mallow.

The Small Mallow Moth (*Eubolia* or *Ortholitha limitata*, Plate 22, fig. 18) is rather smaller. The fore wings are dull ochreous, with a brown or olive-grey tinge, with several brown transverse lines, and a dark brown central area, containing a black central spot. The hind wings are yellowish grey, with two dull brown transverse lines and dark hind margins. The caterpillar is yellowish grey, finely pubescent, with indistinct darker lines. It feeds on low plants.

The Treble Bar (*Anaitis plagiata*, Plate 23, fig. 1) has dull yellow fore wings, tinged with brown or olive-green, with several dull brown transverse lines and a dark brown central area. The hind wings are yellowish grey, with two dull brown transverse lines and dark hind margins. The caterpillar is coppery brown, with yellow incisions, a dark dorsal and a light lateral line, the latter being bordered with black. It feeds on wormwood.

The last Geometer we will mention here is the Chimney Sweep (*Odezia atrata*, Plate 22, fig. 19), which is remarkable for its sooty black colour, with a slight white edging to the fore wings. It is found in meadows, and especially on hill-sides flying by day; and its caterpillar, which is green with or without dark dorsal and lateral lines, feeds on chervil.

THE SMALLER MOTHS

The small moths are known collectively as *Micro-Lepideptera*, and are nearly as numerous as the larger ones, which we have been discussing. But they are less suited to popular treatment on account of their small size bringing them less under observation, and also on account of the great number of closely allied species. So we shall here confine ourselves to noticing a few of the commoner and more interesting species.

The Pyrales, or Pearls, are slender-bodied moths with slender antennæ, long and rather narrow wings, and long and rather spiny legs.

Several species are common in houses, such as the Meal Moth (*Pyralis farinalis*), which is found almost all over the world. It measures about an inch in expanse, and is reddish grey, with two whitish lines crossing the wings, widely apart, between which the space is yellowish grey. The whitish caterpillar lives among straw, etc.

A larger and duller-coloured household species is the Tabby Moth (*Aglossa pinguinalis*), which is commonly met with resting on walls in barns, etc.; it is brownish grey, with paler lines, and a black dot in the middle of the wings. The brown caterpillar has similar habits to the last.

The Garden Pebble (*Pionea forficalis*) has rather long and narrow fore wings, an inch in expanse, of a yellowish grey, with three oblique brown bands. It is very common in gardens, where its yellowish caterpillar feeds on cabbage.

Two very common moths of this group swarm in nettle-beds, in company with the Snout (*Hypena proboscidalis*), already mentioned at p. 127. These are the Mother of Pearl (*Botys ruralis*) and the Small Magpie (*Eurrhypara urticata*). The Mother of Pearl measures an inch and a half across the wings, which are pearly grey, with darker zig-zag lines; the Small Magpie is rather smaller, and is white, with rows of large, more or less connected, blackish spots, and some orange marks at the base of the wings. The greenish caterpillar feeds on nettle.

Several beautiful little moths of this group fly by day, on hill-sides, such as the Crimson and Gold (*Pyrausta purpuralis*) reddish purple with yellow spots; and the Silver-barred and Wavy-barred Sables (*Ennychia cingulalis* and *anguinalis*), black, with white streaks. An allied species, the White Spot

(*Ennychia octomaculata*), black, with large white spots, is common in woods. None of these measure more than three-quarters of an inch across the wings. The caterpillars feed on mint, thyme, golden rod, etc.

Among water plants we find several species of white moths with blackish and yellowish markings, which are known as China Marks ; they rarely measure more than about an inch in expanse. The caterpillars feed exposed or in cases, on duckweed, water-lily, etc., and some species are provided with branchiæ.

If we walk in a meadow in summer we can hardly fail to notice many brown, straw-coloured, or whitish moths, an inch or so in expanse, which start up before us, fly a few yards, and then settle on the grass, and suddenly disappear. If we follow them up, we find that the palpi project in front of the head like a beak, the fore wings are long and narrow, and the hind wings, which are generally grey or brown, are broad. When they settle these are closely folded, with the fore wings above them in such a way as to appear almost tubular, when the whole insect becomes very narrow and inconspicuous. These are Grass-moths of the genus *Crambus*, of which there are a great number of species, some of which have the fore wings adorned with bright silver streaks. The caterpillars feed among moss.

Somewhat allied to these are the Honey-moths belonging to the small family *Galleriidæ*, of which we have three or four British species, which are reddish brown, varied with greenish, and about an inch and a half in expanse. The fore wings are broader, and the hind wings narrower in proportion, than in the *Crambidæ*. The caterpillars live in beehives, where they eat through the combs, and often cause much mischief.

The Plume Moths belonging to the family *Pterophoridæ* much resemble Crane Flies (Daddy Longlegs) in appearance, having very long and slender legs, wings, and antennæ. In nearly all the species the front wings are divided into two distinct feathers, and the hind wings into three. The moths may often be seen at rest on grass or leaves. There are about thirty British species, some of which are very common, such as the White Plume Moth (*Alucita pentadactyla*), which is about an inch in expanse and pure white ; it is found in weedy places, strawberry beds, etc., and its caterpillar, like that of several other Plumes, feed on *Convolvulus*.

Another common species, the Brown Plume Moth (*Alucita*

fusca) is dark brown, with a blackish spot on the fore wings; the caterpillar feeds on speedwell.

The Twenty Plume Moth (*Orneodes hexadactyla*), the only British representative of the family *Orneodidæ*, measures two-thirds of an inch in expanse. It is pale grey, with darker bands, and when sitting with outspread wings it has the appearance of a small Looper Moth (a Pug of the genus *Eupithecia*), but on close examination we find that each wing is split into six distinct feathers. Its caterpillar feeds on the buds of the honeysuckle.

The *Tortrices*, Leaf Rollers, or Bell Moths, include a large number of moths of small size, generally with rather short wings, which are broad and truncated at the extremity. The front wings are more or less varied, but do not exhibit any very constant pattern; the hind wings are generally light brown or grey, and rounded. Many of the caterpillars live in rolled-up leaves, and others feed on seeds or fruit, and some species are very destructive.

One of the commonest and most typical of these moths is the Green Oak Moth (*Tortrix viridana*). It abounds about oak trees, where its small green caterpillar lives. If alarmed, the caterpillars drop down by a thread, climbing up again as soon as the danger seems to have passed. The moth, which measures nearly an inch in expanse, has green fore wings, with the costa yellowish; the hind wings are brownish grey. When at rest, it closes its wings over its back, which gives it something of the shape of a bell.

A variety of *Tortrices* feed on various common plants, such as rose and hawthorn. The species of *Pardia* and *Spilonota* found on rose, are brown varied with grey, and when at rest might easily be mistaken for small patches of bird-droppings; the species of *Cræsia* are yellow or orange, and the little *Cræsia holmiana*, which is only half an inch in expanse, has a conspicuous white spot on the front edge of the wings.

Several common species of *Peronea* are so variable that it is difficult to find two specimens alike, and numbers of varieties were described as distinct species by the older Entomologists.

The species of *Carpocapsa* feed on fruits; and the caterpillar of the Apple Moth (*Carpocapsa pomonella*) is a great pest in orchards all over the world. The moth expands three-quarters of an inch, and the fore wings are grey, strippled with brown and coppery towards the extremity; the small pink caterpillar lives in apples and pears, and also under the bark of the trees.

Two conspicuous yellow moths, measuring less than an inch in expanse are common among thistles. These are the Straw Moths. *Xanthosetia hamana* is mottled with reddish, and *X. zœgana* has a peculiar angulated brown mark towards the extremity of the fore wings.

The last group of moths, the *Tineæ*, is the largest of all, including nearly one-third of all the British species. They are of small size, many of them being among the smallest moths known, and the wings are usually long and narrow, with long, often very long, fringes of hairs. They are very varied in structure, colour, and habits, and we shall only be able to call special attention to a few of the principal groups. First and foremost of these are the Clothes' Moths, which may be found everywhere in houses, where their caterpillars live in small cases on various fabrics. There are many different kinds, prominent among them being *Tinea pellionella*, a moth about half an inch in expanse, with light brown fore wings marked with three darker dots; and *Tinea tapetzella*, rather larger, with fore wings conspicuously dark at the base, and grey on the outer half. Another notable species is *Tinea granella*, pale grey with blackish spots, which is often very destructive to corn in granaries. Its head is whitish.

But there is another species, the White-shouldered Moth (*Endrosis fenestrella*), which is very common in houses; this is grey, with a very conspicuously white head and thorax. It belongs to the family *Œcophoridæ*, and the caterpillar feeds on refuse of different kinds, and may be looked upon as harmless.

The Long-horn Moths of the family *Adelidæ* are most beautiful objects flying about bushes in spring by day. They expand half an inch on an average, and are coppery green, sometimes with yellow spots and bands. But they are most remarkable for their long slender antennæ, many times the length of the body.

The Small Ermine Moths, belonging to the genus *Hyponomeuta*, abound on hawthorn, apple, box, etc., and are often very destructive. The moths measure nearly an inch in expanse, and are white or grey, with several rows of black dots; the hind wings are grey. The grey caterpillars live gregariously under a web.

Another very injurious insect, found all over the world, is *Plutella cruciferarum*, a moth rather more than half an inch in expanse, with somewhat long grey fore wings, with darker

markings, and a pale band on the hinder edge. The caterpillar feeds on cabbage, turnip, etc.

The moths called "Flat-Bodies" by collectors, belong to the genus *Depressaria* in the great family *Gelechiidæ*, and generally measure nearly an inch across the wings. Their bodies are rather stout and depressed, and the hind wings are broader, with shorter fringes than usual in the *Tineæ*. They are brown or grey, and are usually met with rather late in summer or autumn. A more conspicuous species of this family is *Harpella geoffroyella*, three-quarters of an inch in expanse, which has yellow fore wings varied with brown, with blue markings towards the base, and two conspicuous yellow spots. It is common in woods in the daytime.

The family *Œcophoridæ* includes several brightly-coloured species; among them, *Œcophora sulphurella*, which has yellowish brown fore wings with yellow markings, and yellow black-bordered hind wings; it measures rather more than half an inch in expanse, and its caterpillar lives in rotten wood.

Among our common garden insects is the little *Gracilaria syringella*, half an inch in expanse, which is pale grey, with darker markings. It is a very slender delicate insect, and its caterpillar feeds on blotches between the substance of the leaves of lilac.

The species of *Coleophora* are slender long-winged moths, generally of pale colour, and expanding about half an inch, which are interesting because the caterpillars of many of the species live in curious cases on various plants.

Several species of the genus *Elachista* are very small insects (less than half an inch in expanse), and their caterpillars live on grass-leaves.

The smallest moths known, however, are the *Nepticulidæ*, which are often brilliantly coloured, but sometimes do not measure as much as a quarter of an inch in expanse; their caterpillars live in mined galleries in the leaves of bramble, nut, etc.

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LIST OF BOTANICAL NAMES MENTIONED

Alder, *Alnus.*
Anthyllis vulneraria, Kidney Vetch.
Apple, *Pyrus malus.*
Aristolochia, Milk Weed.
Aspen, *Populus tremula.*
Azalea procumbens.
Barberry, *Berberis vulgaris.*
Beaked Rush, *Rhyncospora alba.*
Bean, *Vicia.*
Bedstraw, *Galium.*
Beech, *Fagus sylvatica.*
Bilberry, *Vaccinium myrtillus.*
Bindweed, *Convolvulus.*
Birch, *Betula.*
Bird-Cherry, *Prunus padus.*
Bird's-foot Trefoil, *Lotus corniculatus.*
Bitter Cress, *Cardamine impatiens.*
,, Vetch, *Orobus.*
Blackberry, *Rubus fructicosus.*
Blackthorn, *Prunus spinosa.*
Box, *Buxus sempervirens.*
Bramble, *Rubus fructicosus.*
Broom, *Sarothamnus vulgaris.*
Buckthorn, *Rhamnus cathartica.*
Bugle, *Ajuga reptans.*
Burdock, *Arctium, lappa.*
Cabbage, *Brassica oleracea.*
Campion, *Silene.*
,, , Red, *Lychnis carota.*
Cardamine impatiens, Bitter Cress.
Carrot, *Daucus carota.*
Catchfly, *Lychnis.*
Chamomile, *Anthemis nobilis.*
Cherry, *Cerasus.*
Chervil, *Anthriscus sylvestris.*
Chestnut, *Castanea.*
Chickweed, Mouse-ear, *Cerastium arvense.*
Chicory, *Chicorium intybus.*
Clematis vitalba, Traveller's Joy.
Clover, *Trifolium.*
Columbine, *Aquilegia.*
Convolvulus, Bindweed.
Corn.
,, , Indian, *Zea.*
Cotton Grass, *Eriophorum latifolium.*
Couch Grass, *Triticum repens.*
Cowslip, *Primula veris.*
Cow-wheat, *Melampyrum.*
Cress, Bitter, *Cardamine impatiens.*
,, , Indian, *Tropæolum majus.*
,, , Water, *Nasturtium.*
Cruciferæ.
Currant, *Ribes.*
Cypress Spurge, *Euphorbia cyparissias.*
Dandelion, *Taraxacum officinale.*
Dead-nettle, *Lamium.*
Dock, *Rumex.*
,, , *Great Water, Rumex hydrolapathum.*
Dog Violet, *Viola Canina.*
Duckweed, *Lemna.*
Dyer's Weed, *Genista tinctoria.*
Elder, *Sambucus niger.*
Elm, *Ulmus.*
Epilobium, Willow Herb.
Erodium, Stork's Bill.
Euphorbia cyparissias, Cypress Spurge.
Euphorbia paralias, Sea Spurge.
Ferns, *Filicineæ.*
Figwort, *Scrophularia.*
Fir, *Abies.*
Flag, *Iris.*
Flax, *Linum usitatissimum.*
Forget-me-not, *Myosotis palustris.*
Foxglove, *Digitalis purpurea.*
Fritillary, *Fritillaria.*
Fuchsia.
Fungi.
Furze, *Ulex europæus.*
Genista tinctoria, Dyer's Weed.
Geranium, Wild, *Geranium robertianum.*
Golden Rod, *Solidago virgaurea.*
Gooseberry, *Ribes grossularia.*
Grass, *Gramineæ.*
Great Water Dock, *Rumex hydrolapathum.*
Ground Ivy, *Nepeta.*
Groundsel, *Senecio vulgaris.*
Hair-grass, *Deschampsia.*
Hawk-weed, *Hieracium.*
Hawthorn, *Cratægus oxyacantha.*
Hazel, *Coryulus avellana.*
Heartsease, *Viola tricolor.*
Heath, *Erica.*
Heather, *Calluna vulgaris.*
Helianthemum, Rock Rose.
Hemp, *Cannabis saliva.*
Hippocrepis comosa, Horse-shoe Vetch.
Holly, *Ilex.*
Honeysuckle, *Lonicera periclymenum.*
Hop, *Humulus lupulus.*
Horse-shoe Vetch, *Hippocrepis comosa.*
Indian Corn, *Zea.*
,, Cress, *Tropæolum majus.*

Ivy, *Hedera helix.*
,, , Ground, *Nepeta.*
Jasmine, *Jasminum.*
Juniper, *Juniperus communis.*
Kidney-Vetch, *Anthyllis vulneraria.*
Knot-grass, *Polygonum aviculare.*
Larkspur, *Delphinium.*
Lettuce, *Lactuca.*
Lichens.
Lilac, *Syringa vulgaris.*
Lime, *Tilia europæa.*
Lotus corniculatus, Bird's-foot Trefoil.
Mace, Reed, *Typha latifolia.*
Madder, *Rubia.*
Mallow, *Malva.*
Maple, *Acer campestre.*
Melampyrum, Cow-wheat.
Milk Parsley, *Peucedanum palustre.*
Milk-weed, *Aristolochia.*
Mint, *Mentha.*
Monkshood, *Aconitum napellus.*
Moss.
Mouse-ear Chickweed, *Cerastium arvense.*
Mulberry, *Morus niger.*
Mullein, *Verbascum.*
Nasturtium.
Nettle, *Urtica.*
,, , Dead, *Lamium.*
Nightshade, *Solanum.*
Nut, *Corylus avellana.*
Oak, *Quercus.*
Onobrychis sativa, Sainfoin.
Ononis spinosa, Rest Harrow.
Orache, *Atriplex.*
Orobus, Bitter Vetch.
Parsley, Milk, *Peucedanum palustre.*
Pea, *Pisum.*
Pear, *Pyrus communis.*
Peucedanum palustre, Milk Parsley.
Pine, *Pinus.*
Pink, *Dianthus.*
Plantain, *Plantago.*
Plum, *Prunus.*
Poplar, *Populus.*
Potato, *Solanum tuberosum.*
Primrose, *Primula acaulis.*
Privet, *Ligustrum vulgare.*
Pumpkin, *Cucurbita.*
Ragwort, *Senecio jacobæa.*
Raspberry, *Rubus idæus.*
Red Campion, *Lychnis divica.*
Reed, *Phragmites.*
,, Mace, *Typha latifolia.*
Rest-harrow, *Ononis spinosa.*
Rhododendron.
Rhynchospora alba, Beaked Rush.
Rock Rose, *Helianthemum vulgare.*
Rose, *Rosa.*
Rumex hydrolapathum, Great Water Dock.
Rush, Beaked, *Rhynchospora alba.*
Sainfoin, *Onobrychis sativa.*
Sallow, *Salix alba.*
St. John's Wort, *Hypericum perforatum.*
Saxifrage, *Saxifraga.*
Scabious, *Scabiosa.*
Sea Spurge, *Euphorbia paralias.*
,, Thrift, *Statice maritima.*
Sedge, *Carex.*
Sloe, *Prunus spinosa.*
Sorrel, *Rumex.*
Sow-thistle, *Sonchus oleraceus.*
Speedwell, *Veronica.*
Spurge, Cypress, *Euphorbiacyparissias*
Spurge, Sea, *Euphorbia paralias.*
Sticta pulmonaria.
Stork's Bill, *Erodium cicutarium.*
Strawberry, *Fragaria vesca.*
Sycamore, *Acer pseudoplatanus.*
Thistle, *Carduus.*
,, , Sow, *Sonchus oleraceus.*
Thrift, Sea, *Statice maritima.*
Thyme, *Thymus.*
Tobacco, *Nicotiana.*
Tomato, *Solanum, lycopersicum.*
Traveller's Joy, *Clematis vitalba.*
Trefoil, *Lotus.*
Triticum repens, Couch Grass.
Tropæolum, Indian Cress.
Turnip, *Brassica campestris rapa.*
Typha latifolia, Reed Mace.
Umbelliferæ.
Vetch, *Vicia.*
,, , Bitter, *Orobus.*
,, , Horse-shoe, *Hippocrepis comosa.*
Vetch, Kidney, *Anthyllis vulneraria.*
Vine, *Vitis vinifera.*
Violet, *Viola.*
,, , Dog, *Viola canina.*
Virginian Creeper, *Vitis hederacea.*
Watercress, *Nasturtium.*
Water Dock, Great, *Rumex hydrolapathum.*
Water Lily, *Nymphæa.*
Whitethorn, *Cratægus oxyacantha.*
Wild Geranium, *Geranium robertianum.*
Wild Rose, *Rosa.*
,, Thyme, *Thymus.*
Willow, *Salix alba.*
Willow-Herb, *Epilobium.*
Woodruff, *Asperula.*
Wormwood, *Artemisia.*
Yarrow, *Achillea millefolium.*
Yellow Flag, *Iris pseudacorus.*

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. Epinephele jurtina L. 2. E. tithonus L. 3. Coenonympha pamphilus L. 4. Neme-
bius lucina L. 5. Thecla spini Schiff. 6. Th. ilicis Esp. 7. Th. pruni L. 8. Chryso-
phanus virgaureae L. 9. Ch. phlaeas L. 10. Lycaena argyrognomon Brgstr.
1. L. icarus Rott. 12. L. damon Schiff. 13. L. minimus Fuessl. 14. L. arion L.

. Pamphila palaemon Pall. 2. Adopaea thaumas Hufn. 3. Augiades comma L.
. Carcharodus alceae Esp. 5. Hesperia carthami Hb. 6. Thanaos tages L.
7. Acherontia atropos L. 8. Smerinthus populi L. 9. S. ocellata L.

. Dilina tiliae L. 2. Sphinx ligustri L. 3. Protoparce convolvuli L. 4. Hyloicus pinastri L. 5. Deilephila galii Rott.

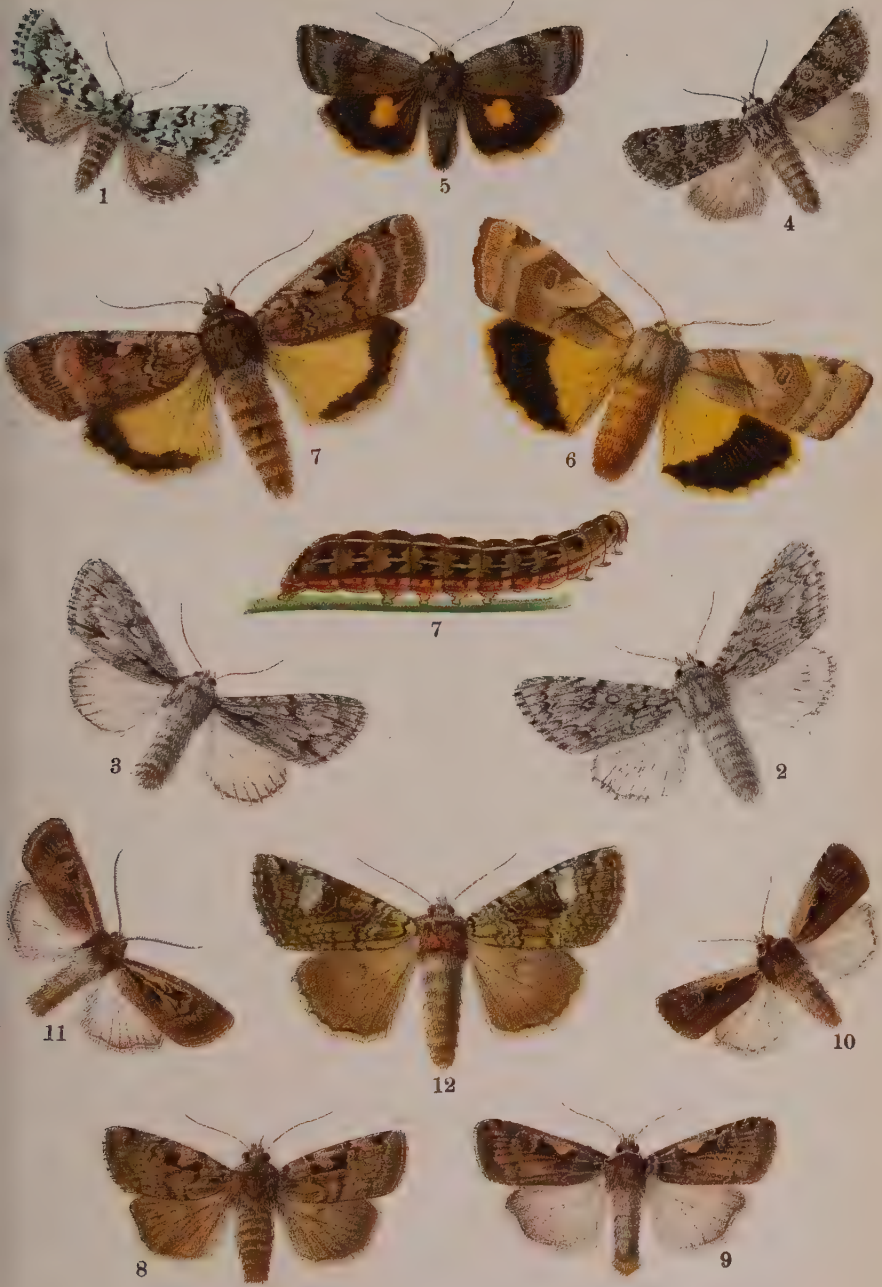
. Deilephila euphorbiae L. 2. Chaerocampa elpenor L. 3. Metopsilus porcellus L.
. Pterogon proserpina Pall. 5. Macroglossa stellatarum L. 6. M. croatica Esp.
7. Hemaris scabiosae Z.

. Cerura bifida Hb. 2. Dicranura vinula L. 3. Stauropus fagi L. 4. Drymonia rimacula Esp. 5. Notodonta ziczac L. 6. Leucodonta bicoloria Schiff. 7. Lophopteryx camelina L. 8. Ptilophora plumigera Esp. 9. Phalera bucephala L.

1. Pygaera pigra Hufn. 2. Thaumetopoea processionea L. 3. Orgyia gonostigma F.
4. Dasychira pudibunda L. 5. Euproctis chrysorrhoea L. 6. Lymantria dispar L.
7. L. monacha L. 8. Malacosoma neustria L. 9. Eriogaster lanestris L.

. Lasiocampa quercus L. 2. Cosmotriche potatoria L. 3. Gastropacha quercifolia L. 4. Dendrolimus pini L. 5. Endromis versicolora L.

1. Saturnia pyri Schiff. 2. S. spini Schiff. 3. Aglia tau L. 4. Drepana falcataria L. 5. D. lacertinaria L. 6. Thyris fenestrella Sc.



1. Diphtera alpium Osbeck. 2. Acronicta aceris L. 3. A. psi L. 4. A. rumicis L.
5. Agrotis janthina Esp. 6. A. fimbria L. 7. A. pronuba L. 8. A. triangulum Hufn.
9. A. C nigrum L. 10. A. plecta L. 11. A. tritici L. 12. A. prasina F.

1. Charaeas graminis L. 2. Epineuronia popularis F. 3. Mamestra brassicae L.
4. M. persicariae L. 5. M. pisi L. 6. Dianthoecia compta F. 7. D. capsincola Hb.
8. Miana strigilis Cl. 9. Bryophila raptricula Hb. 10. Diloba caeruleocephala L.
11. Valeria oleagina F. 12. Hadena monoglypha Hufn. 13. Ammoconia caecimacula F.
14. Polia flavicincta F.

Dichonia aprilina L. 2. Dipterygia scabriuscula L. 3. Trachea atriplicis L. Euplexia lucipara L. 5. Brotolomia meticulosa L. 6. Mania maura L. 7. Jaspidea elsia L. 8. Hydroecia nictitans Bkh. 9. Gortyna ochracea Hb. 10. Nonagria typhae Thnbg. 11. Luceria virens L. 12. Leucania pallens L. 13. L. L album L.

1. Grammesia trigrammica Hufn. 2. Caradrina alsines Brahm. 3. Amphipyra livida F. 4. A. pyramidea L. 5. Taeniocampa gothica L. 6. T. stabilis View. 7. Panolis griseovariegata Goeze. 8. Calymnia trapezina L. 9. Orthosia helvola L. 10. Xanthia aurago F. 11. X. fulvago L. 12. Hoporina croceago F. 13. Orrhodia fragariae Esp. 14. O. vaccinii L.

. Scopelosoma satellitia L. 2. Xylina furcifera Hufn. 3. X. ornitopus Rott. 4. Calo-ampa vetusta Hb. 5. Calophasia lunula Hufn. 6. Cucullia scrophulariae Capieux. . C. umbratica L. 8. C. lucifuga Hb. 9. C. argentea Hufn. 10. Anarta myrtilli L. 1. Heliothis dipsacea L. 12. Chariclea delphinii L. 13. Pyrrhia umbra Hufn.

1. Acontia luctuosa Esp. 2. Erastria deceptoria Sc. 3. Prothymnia viridaria Cl.
4. Scoliopteryx libatrix L. 5. Abrostola triplasia L. 6. Plusia C aureum Knoch.
7. P. moneta F. 8. P. chrysitis L. 9. P. festucae L. 10. P. gamma L. 11. Euclidia
mi Cl. 12. E. glyphica L. 13. Pseudophia lunaris Schiff. 14. Catephia alchymista Schiff.

1. Catocala fraxini L. 2. C. electa Bkh. 3. C. nupta L. 4. C. sponsa L. 5. C. promissa Esp.

1. Catocala fulminea Scop. 2. Toxocampa craccae F. 3. Laspeyria flexula Schif
4. Zanclognatha tarsicrinalis Knoch. 5. Herminia tentacularia L. 6. Hypena probo
scidalis L. 7. H. rostralis L. 8. Habrosyne derasa L. 9. Thyatira batis L
10. Cymatophora or F. 11. C. octogesima Hb. 12. Polyploca flavicornis L
13. Brephos parthenias L.

Pseudoterpna pruinata Hufn. 2. Geometra papilionaria L. 3. Euchloris smaragaria F. 4. Nemoria viridata L. 5. Acidalia trilineata Sc. 6. A. similata Thnbg. A. muricata Hufn. 8. A. bisetata Hufn. 9. A. aversata L. 10. A. remutaria Hb. 1. A. ornata Sc. 12. Ephyra annulata Schulze. 13. E. punctaria L. 14. Rhodostrophia vibicaria Cl. 15. Timandra amata L. 16. Lythria purpuraria L. 17. Orthosia litha cervinata Schiff. 18. O. limitata Sc. 19. Odezia atrata L.

Anaitis plagiata L. 2. Lobophora carpinata Bkh. 3. Cheimatobia brumata L. Triphosa dubitata L. 5. Larentia dotata L. 6. L. ocellata L. 7. L. juniperata L. L. viridaria F. 9. L. hastata L. 10. L. bilineata L. 11. L. berberata Schiff. 2. Tephroclystia scabiosata Bkh. 13. Chloroclystis rectangulata L. 14. Phibalapteryx vitalbata Hb. 15. Abraxas grossulariata L. 16. A. marginata L.

1. Numeria pulveraria L. 2. Metrocampa margaritata L. 3. Ennomos qu
cinaria Hufn. 4. Selenia bilunaria Esp. 5. Hygrochroa syringaria L. 6. Him
pennaria L. 7. Angerona prunaria L. 8. Ourapteryx sambucaria L. 9. Opist
graptis luteolata L. 10. Venilia macularia L. 11. Semiothisa notata L. 12. Hyber
leucophaearia Schiff. 13. H. marginaria Bkh. 14. Phigalia pedaria F.

1. Biston strataria Hufn. 2. Amphidasis betularia L. 3. Boarmia cinctaria Schiff. 4. B. consortaria F. 5. B. lichenaria Hufn. 6. Gnophos obscuraria Hb. 7. Ematurga atomaria L. 8. Bupalus piniarius L. 9. Thamnonoma wauaria L. 10. Phasiane clathrata L. 11. Scoria lineata Sc. 12. Earias clorana L. 13. Hylophila prasinana L. 14. Dysauxes ancilla L. 15. Spilosoma menthastri Esp. 16. Phragmatobia fuliginosa L.

1. Rhyparia purpurata L. 2. Diacrisia sanio L. 3. Arctia caja L. 4. A. villica
5. A. hebe L. 6. Pericallia matronula L. 7. Callimorpha dominula L.
8. C. quadripunctaria Poda.

1. Hipocrita jacobaeae L. 2. Deiopeia pulchella L. 3. Nudaria mundana L. 4. Mi
tochrista miniata Forst. 5. Endrosa roscida Esp. 6. Oeonistis quadra L. 7. Lithosi
complana L. 8. L. sororcula Hufn. 9. Zygaena scabiosae Scheven. 10. Z. achi
leae Esp. 11. Z. meliloti Esp. 12. Z. trifolii Esp. 13. Z. filipendulae L. 14. Z
ephialtes L. 15. Z. carniolica Sc. 16. Ino statices L. 17. Cochlidion limacodes Hufn

1. Acanthopsyche opacella HS. 2. Psyche viciella Schiff. 3. Apterona crenulella Br
4. Trochilium apiformis Cl. 5. Sesia scoliaeformis Bkh. 6. Sesia tipuliformis C
7. S. myopaeformis Bkh. 8. S. ichneumoniformis F. 9. Cossus cossus L. 10. Ze
zera pyrina L. 11. Hepialus humuli L. 12. H. sylvina L. 13. H. hecta L.